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The World Bank

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Report No. 3707-KO

STAFF APPRAISAL REPORT

KOREA

TECHNOLOGY DEVELOPMENT PROJECT

February 25, 1982

Industrial Projects Department

CURRENCY EQUIVALENTS

US$1	=	Won 710 (as of Febr. 15, 1982)
US$1 Million	=	Won 0.71 Billion
Won 1	=	US$0.00141
Won 1 Million	=	US$1,408
Won 1 Billion	=	US$1.41 Million

MAIN ABBREVIATIONS AND ACRONYMS

AIRI	=	Association of Industrial Research Institutes
CDTI	=	Centro Para El Desarrollo Technologico Industrial
DFCs	=	Development Finance Companies
EPB	=	Economic Planning Board
FKI	=	Federation of Korean Industries
GNP	=	Gross National Product
Government	=	Government of the Republic of Korea
KAIST	=	Korea Advanced Institute of Science and Technology
KDB	=	Korea Development Bank
KDI	=	Korea Development Institute
KFSB	=	Korea Federation of Small Business
KIET	=	Korea Institute of Electronics Technology
KIST	=	Korea Institute of Science and Technology
KLB	=	Korea Long-Term Credit Bank
KOPTEC	=	Korea Production Technology Corporation
KTAC	=	Korea Technology Advancement Corporation
KTDC	=	Korea Technology Development Corporation
MCI	=	Ministry of Commerce and Industry
MIT/CPA	=	Massachusetts Institute of Technology/ Center for Policy Alternatives
MOST	=	Ministry of Science and Technology
R&D	=	Research and Development
RD&E	=	Research, Development and Engineering
SMI	=	Small and Medium Scale Industry
SMIB	=	Small and Medium Industry Bank
SMIPC	=	Small and Medium Industry Promotion Corporation
TDR	=	Technology Development Reserve
UNDP	=	United Nations Development Programme

FISCAL YEAR

Government and KTDC: January 1 - December 31

KOREA

APPRAISAL OF TECHNOLOGY DEVELOPMENT PROJECT

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This report was prepared by N. Tin, Y.P. Lee and V. Bates of Industrial Projects Department.

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IBRD Map of Korea (IBRD 12351R1)

DOCUMENTS CONTAINED IN PROJECT FILE

1. Long-Term Prospect for Economic and Social Development (1977-91), Korea Development Institute (KDI), 1978.

2. A Summary Draft of the Fifth Five-Year Economic and Social Development Plan (1982-86), EPB, September 1981.

3. The Fifth Five-Year Plan (1982-86): Plan for Science and Technology Area (Draft), MOST, April 1981.

4. Manpower Projection and Strategies for the Republic of Korea (1979-91), Korea Education Development Institute, 1980.

5. Survey Report for R&D Fund Demand by Korean Private Industrial Enterprises, Association of Industrial Research Institute (AIRI), January 1981.

6. Science and Technology Annual, MOST, 1980.

7. Final Report on Korea Technology Development Project, MIT/CPA, February 11, 1981.

8. Technology Development Promotion Law & Enforcement Decree.

9. Korea Technology Development Corporation (KTDC) Act & Enforcement Decree.

10. KTDC Articles of Incorporation.

11. KTDC Organizational By-Laws.

12. KTDC Working Papers on Financial Projections.

I. INTRODUCTION

1.01 The Government of the Republic of Korea has requested Bank assistance to finance a project that would promote and facilitate technological development of the country's industrial sector. The project consists of: (i) assisting the institutional development of the Korea Technology Development Corporation (KTDC), which was established in April 1981 to promote and finance private industry's projects to upgrade technological capability, broadly referred to as research, development and engineering (RD&E) projects: and (ii) providing a line of credit to KTDC for its financing operations.

1.02 KTDC was set up with the strong support and participation of private industry: 60% of its authorized share capital of Won 15 billion (US$21 million equivalent) comes from private industry, and 40% from the Government. KTDC's legal framework provides it with the autonomy, flexibility and dynamism of a private organization, which are most critical to its success. KTDC's total financing requirement over 1981-84 is estimated at about Won 66 billion (US$92 million equivalent) on a commitment basis, of which about Won 36 billion equivalent (US$50 million) would be in foreign exchange. The proposed Bank loan of US$50 million equivalent would finance 100% of this foreign exchange requirement; the balance of the financing requirement would be met from KTDC's share capital of Won 15 billion (US$21 million equivalent), Government loans of Won 6 billion (US$8.5 million equivalent) and Government guaranteed bonds of Won 9 billion (US$12.5 million equivalent).

1.03 Since the mid-1960s, the Korean economy has progressed rapidly based on the Government's export-led industralization strategy. During the last fifteen years, real GNP grew by over 9% p.a., and exports by about 27% p.a. in volume. This outstanding performance has been spearheaded by a robust manufacturing sector. Within this sector, light industry, including textiles, clothing, footwear and plywood, has played a crucial role in providing initial growth momentum through rapid export expansion of labor-intensive products. Since the early 1970s, however, Korea's comparative advantage has gradually shifted towards skill and technology-intensive industries, due mainly to the rising domestic real wage rate and increasing competition from newly industrializing low wage countries. During 1977-79, Korea spent about 80% of total manufacturing investment in heavy industry whose output at the time represented only about 50% of total manufacturing. In hindsight, investment in heavy industry might have exceeded, in some instances, the levels dictated by market size, financing, and particularly technological and managerial capability.

1.04 Korea has made important efforts in building up a technological base to support its industrial reorientation. As a percentage of GNP, total R&D spending doubled in the last decade, from 0.3% in 1970, to 0.6% in 1979, which was among the highest in developing countries. During the same period, industrial R&D spending increased rapidly, at an annual rate of over 20% p.a. Despite this impressive growth, the R&D sector in Korea is still faced with a number of important weaknesses. First, R&D spending by industry accounted for only 34% of the country's total in 1979 with the balance by public sector research institutes; by contrast, in highly industrialized countries, the

industrial sector accounts for 60-70% of total R&D spending. Second, though some 15 public research institutes have been established with a view to meet industry's growing technological needs, their link with industry is tenuous. Third, R&D manpower resources remain inadequate, dispersed over too many institutes, and have insufficient funds to carry out RD&E work properly, particularly at the development and engineering phases. Fourth, industry's technological capability upgrading efforts are still considerably under-financed, due to the absence of suitable financing instruments in the existing capital market for such software-intensive and/or risky ventures.

1.05 The Government's Fifth Five-Year Plan (1982-86) continues to place top priority in technology and manpower development to maintain a high rate of economic growth, through the development and expansion of skill and technology-intensive industries. By 1986, the Government plans to raise total R&D expenditures to 2.0% of GNP; and by 1991, to 2.5%, 60% of which will be for industry. Policies have been introduced to make industry, rather than the Government, responsible for technology transfer and development, through fiscal and financial incentives for in-house RD&E work, and liberalization of technology imports. Measures have also been taken to rationalize and improve the efficiency of public research institutes. More funds will be allocated to education investments to ensure an adequate supply of technical manpower resources. Further, new financing mechanisms are being introduced - through KTDC - to promote and finance industrial RD&E work as well as acquisition of advanced foreign technologies.

1.06 The proposed project, through KTDC, will attempt to fill the gap in the capital market (para. 1.04) to promote and support industrial technology development in Korea. KTDC will complement the activities of other industrial support organizations, especially financial institutions and public research institutes. It will not compete with or duplicate their functions. It will complement the work of existing financial institutions by (i) focusing its financing on RD&E and other technological capability upgrading activities where existing financial institutions have little presence; and (ii) adopting a range of flexible financing instruments to meet the peculiar needs of risky and/or software-intensive industrial technological development activities, which are not available from existing financial institutions. With respect to RD&E work, KTDC will not itself perform any such activities, but will finance industrial RD&E projects, to be either carried out by industrial firms themselves, or contracted out to public research institutes of their choice. In so doing, KTDC will serve to correct the imbalance in industry's R&D expenditure and to promote a closer link between public research institutes and industry (para. 1.04).

1.07 The Bank has played an important role in the conceptualization and realization of KTDC. In August 1979, the Bank acted as the Executing Agency for a UNDP-financed project, carried out by the Center for Policy Alternatives of the Massachusetts Institute of Technology (MIT/CPA) with the Korea Institute of Science and Technology (KIST) as local counterpart, to assess the technological needs of key industrial subsectors and identify the gaps that must be filled to foster the technological development of Korean

industry. Following a review of the findings of MIT/CPA/KIST, a Bank preparation mission, consisting of Messrs. M. Iskander, N. Tin and S. Thomas, visited Korea in May 1980, to discuss and reach consensus with the Government and industry on the most effective type of institutional arrangement, which was to become KTDC. Subsequent Bank preparation missions visited Korea in October 1980 and March 1981 to further assist the Government, through the Ministry of Science and Technology (MOST), and industry, led by the Association of Industrial Research Institutes (AIRI) and the Federation of Korean Industries (FKI), in defining KTDC's legal framework, articles of incorporation and by-laws, financial structure, organization and management, and operating policies and procedures, necessary for the establishment of KTDC. The project was appraised in July 1981 by Messrs. N. Tin and Y.P. Lee and Miss V. Bates (Industrial Projects Department), and Mr. I. Yaakov (consultant).

1.08 The Bank has assisted the Government's efforts to develop the country's technological capability. The Electronics Technology Project,1/ approved in March 1979, provided the Korea Institute of Electronics Technology (KIET) with sophisticated facilities to enable it to undertake production-oriented development work, and financed an RD&E program that is directly linked to the needs of the electronics industry. The Sector Program on Higher Technical Education,2/ approved in January 1980, aimed at improving the quality of higher technical education and increasing the supply of qualified engineers, technicians and managers. Bank involvement in the proposed project, together with Bank Group assistance currently under consideration for the Korea Technology Advancement Corporation (KTAC) and the Korea Production Technology Corporation (KOPTEC), would be a continuation of its efforts in promoting and enhancing technological development of Korean industry. Through its involvement in the proposed project, the Bank is also expected to increase its knowledge of the field and thus become better equipped to assist other countries that may embark on a similar effort.

II. INDUSTRIAL RESEARCH, DEVELOPMENT AND ENGINEERING (RD&E) IN KOREA

A. The Economic Setting: Growth and Structural Change

2.01 During the last two decades, Korea achieved remarkable economic growth. At the beginning of the 1960s, Korea was one of the poorest developing countries with heavy dependence on agriculture. By the late 1970s, it had become a middle-income, semi-industrialized country. During this period, GNP grew by 9% p.a., amounting to Won 27,000 billion (US$60 billion equivalent) in

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1/ President's Report on the Electronics Technology Project. Report No. P-2486-KO, March 6, 1979.

2/ President's Report on the Higher Technical Education Loan. Report No. P-2694-KO, January 30, 1980.

1979, with per capita income tripled in real terms to US$1,600 (at 1979 prices), and employment doubled to 13.7 million employees in the same year. As Korea lacks raw material inputs, this rapid expansion of the economy was sustained by an outstanding export performance. Specifically, exports grew by 27% p.a. in real terms, from US$100 million, or 4% of GNP, in 1960 to over US$13 billion, or 34% of GNP, in 1978.

2.02 This rapid growth brought about important changes in the structure of the economy in terms of value added, employment and exports. As indicated in the table below, the share of manufacturing value added doubled in less than two decades, from 14% of GNP in 1963, to 27% of GNP in 1979. During 1963-79, the share of manufacturing employment increased from 8% to 23% of total employment, and accounted for over 40%, or nearly 2.5 million jobs, of the total additional employment created during this period. The manufacturing sector's export performance was even more remarkable; its share of total commodity exports increased from 20% in 1961, to 93% in 1979. At the same time, agriculture lost its dominance. During 1963-79, its share fell from 45% to 22% of GNP; from 64% to 37% of total employment; and from 80% to 7% of commodity exports.

Korea - Sector Composition of GNP, Employment and Exports (%)

	Agriculture	Manufacturing	Service	Total
Value-added (% of GNP)				
1963	44.8	14.5	40.7	100.0
1973	27.6	22.2	50.2	100.0
1979	21.9	27.2	50.9	100.0
Employment (% of total employment)				
1963	63.9	8.0	28.1	100.0
1973	51.2	13.7	35.1	100.0
1979	36.6	22.9	40.5	100.0
Export (% of total commodity exports)				
1961	80.0	20.0	-	100.0
1973	10.0	90.0	-	100.0
1979	7.0	93.0	-	100.0

Source: Korea Development Institute (KDI) and Economic Planning Board (EPB), 1980.

2.03 Within the manufacturing sector, heavy industry expanded noticeably, as its share of manufacturing value added increased from 30% in 1963, to 55% in 1979, as shown below:

Korea - Composition of Manufacturing Value Added (%)

	Light Industry	Heavy Industry	Total Manufacturing
1963	70.3	29.7	100.0
1973	63.6	36.4	100.0
1979	45.2	54.8	100.0

Source: KDI, 1980.

2.04 Export Sector. As a result of its outstanding export performance (para. 2.01), Korea's share of the world market grew steadily and, in 1979, Korea accounted for 13% of aggregate manufactured exports from all developing countries. Although this represented only 1% of the total volume of world trade, Korea had managed to establish a dominant position in certain product markets by concentrating its export efforts initially on the US and Japanese markets, and on a limited number of labor-intensive products, where it had the highest comparative advantage. For example, in 1973, Korea accounted for 20-50% of Japanese imports of certain textile products, and its share of US imports reached as much as 40% for plywood. Korea's heavy dependence on US and Japanese markets was gradually reduced from 75% of total exports in 1970, to about 50% in 1979, as it improved its ability to penetrate other foreign markets.

2.05 Korea also made important progress in broadening its export product base. Since 1970, the emphasis on export of light industry products has been reduced considerably; heavy industry's share of total manufactured exports increased from 22% in 1971, to 44% in 1979. The increase in the exports of iron and steel products was most noticeable during the period, with their share expanded from less than 2% of total manufactured exports in 1971, to 12% in 1979.

2.06 The Government's development strategy during the Fifth Five-Year Plan (1982-86) will continue to be outward looking but will involve further opening up of the economy. Exports will continue to be a major engine of growth, and are planned to increase at 11% p.a. in volume. To enhance the competitiveness of Korean industry, emphasis will be placed on quality improvement and product innovation. To this end, the Government will expose domestic producers to foreign competition through import liberalization, encourage the inflow of foreign investment and technologies, and upgrade both the technological capability of Korean industry and technical manpower.

2.07 Further, to encourage its industries to develop in line with the shifting comparative advantages in the world market, the Government intends to reduce excessive intervention in the private sector and to rely increasingly on market mechanisms in the execution of investment and energy policies. Also, to eliminate the potential bottlenecks to industrial growth in Korea from the energy sector, the Government will attempt both to induce investments in energy efficient industries, and to encourage investments for energy conservation. Investment strategies planned for the manufacturing sector are also expected to be changed. For light manufacturing industries,

a greater weight will be attached to investments in quality improvement and the replacement of obsolete facilities. For heavy machinery industries, the emphasis will be laid on complementary investments, and/or investments for parts and components, to enhance the operating ratios of currently underutilized plants and to improve the competitiveness of these industries.

2.08 Despite this change in the method of the Government's economic management, the thrust of the Fifth Five-Year Plan (1982-86) will be the continuous transformation of Korea's industrial structure towards a skill and technology-intensive one. The single most important factor to the success of this transformation, and one of the keys to Korea's continuous prosperity during the next decade, will be how effectively it builds up its technological capability.

B. Korea's Pattern of R&D Spending

2.09 Here, the pattern of R&D spending in Korea is examined to assess the priority of R&D activities within the economy, as well as within R&D establishments; and to evaluate whether the structure of existing R&D establishments is appropriate to Korea's stage of industrialization.

2.10 Total R&D spending increased during the last decade, from Won 10.5 billion in 1970, to Won 174.0 billion in 1979, as shown below:

Korea - Growth of R&D Sector

	Total R&D Spending (Won million, current prices)	R&D Spending/GNP (%)
1970	10,547	0.30
1975	42,663	0.44
1976	60,900	0.46
1977	108,285	0.64
1978	152,418	0.67
1979	174,038	0.60

Source: Ministry of Science and Technology (MOST), 1981.

As percent of GNP, total R&D spending outpaced GNP growth, from 0.3% of GNP in 1970, to 0.6% in 1979. Although this was among the highest in developing countries, it was still considerably smaller than the R&D spending of 2-3% of GNP in industrialized countries. During the Fifth Five-Year Plan (1982-86), the Government plans to further increase investments in R&D to 2.0% of GNP in 1986, as shown in Annex 2-1.

2.11 The sharp increase in R&D spending, from about 0.4% of GNP in the years prior to 1977, to 0.6% of GNP thereafter, is connected with the establishment of some 15 new public research institutes (commonly referred to as "non-

profit research institutes" as shown in Annex 2-2) by the Government, and several private research institutes by major industrial groups. Thus, a large part of R&D spending during 1977-79 was for bricks and mortar. Further, it should be noted that the definition of R&D in developing countries, including Korea, often incorporates activities of routine or minor nature, such as product testing, quality control, market research, etc., which are not considered as proper R&D in industrialized countries. Consequently, Korea's R&D spending, if measured as in industrialized countries, would be somewhat lower than the 0.6% of GNP reported in 1979.

2.12 Despite the aforementioned impressive growth in the R&D sector, Korea's R&D spending was not sufficiently focused on serving the growing technological needs of industry. Though industry has made important progress, its share of total R&D spending reached only 34% in 1979; the balance of 66% was accounted for by the public sector research institute system (Government institutes, public institutes and universities). This contrasts sharply to the structure of the R&D sector in industrialized countries, where the increasing complexity and cost of development work have led to industry's dominance in total R&D performance, to over 60%, as shown below:

Korea - R&D Spending By Sector Performance
(Won billion, current prices)

	Government Institutes		Public Institutes		Industry		Universities		Total	
	Amount	(%)	Amount	(%)	Amount	(%)	Amount	(%)	Amount	(%)
Korea:										
1976	20.4	(34)	23.3	(38)	15.1	(25)	1.9	(3)	60.9	(100)
1979	47.5	(27)	50.7	(29)	59.3	(34)	16.5	(10)	174.1	(100)
Japan:										
1978		(14)		(2)		(64)		(20)		(100)
USA:										
1977		(15)		(3)		(67)		(15)		(100)

Source: MOST, 1981.

2.13 The dominance of the public sector research institute system, per se, is not necessarily undesirable. In fact, in developing countries, the public sector is often the only one with the resources needed to establish and maintain the technological infrastructure, such as R&D institutes, required to cater to the country's technological needs. The issue is whether public sector institutes serve industry effectively. In Korea, the public sector research institute system does not seem to have the inclination and capability to supply industry with rapidly growing and increasingly complex industrial

technologies. As such, basic and applied research represented 53% of total R&D spending in 1979, with development work accounting for only 47%. By contrast, Japan and USA spent 40% on basic and applied research and about 60% of the total R&D on development work, as shown below:

Korea - Character of R&D by Stage of Research and Development (%)

	Basic Research /a	Applied Research /b	Development /c	Total
Korea:				
1974	26	44	30	100
1979	23	30	47	100
Japan:				
1978	17	25	58	100
USA:				
1977	13	23	64	100

Source: MOST, 1981.

/a Basic research - Original investigations for the advancement of scientific knowledge not having specific commercial objectives.
/b Applied research - Investigations directed to the discovery of scientific knowledge having specific commercial objectives with respect to products or processes.
/c Development - Technological activities of non-routine nature concerned with translating research findings or other scientific knowledge into products or processes.

C. Technological Manpower Resources

2.14 Technological manpower (scientists and engineers) is the most critical element in RD&E. Both the allocation of scientists and engineers to the R&D sector, and their deployment within the sector, determine the effectiveness of a country's R&D effort. In recent years, Korea has dramatically increased the technological manpower available for R&D, from 11,600 researchers in 1976, to 15,700 in 1979, already exceeding the Fourth Five-Year Plan's projection of 14,000 for 1981. But the manpower resources remain inadequate, dispersed over too many research institutes (para. 2.11), and have little resources to carry out proper R&D (para. 2.16), particularly at the development and engineering phases, which require considerable knowledge of both theoretical principles and practical know-how in engineering and manufacturing. Further, in terms of the number of scientists and engineers employed in R&D per 1,000 people, Korea's R&D manpower increased from 0.3 in 1976, to 0.4 in 1979, but is still far below the comparable figures of 2-3 in industrialized countries. The Government's recent decision to expand and upgrade science and engineering programs in universities aims to increase the supply of technological manpower, as well as to improve the quality, to meet Korea's needs during the next decade.

2.15 The pattern of deployment of technological manpower within the R&D sector did not change during 1977-79, as illustrated in the following table:

Korea - Deployment of Technological Manpower

	Public Sector Institutes		Industry		Universities		Total	Per 1,000 People
	persons	(%)	persons	(%)	persons	(%)	persons	persons
Korea:								
1976	3,590	(30)	3,260	(28)	4,810	(42)	11,660	0.3
1979	4,256	(27)	4,405	(28)	7,050	(45)	15,711	0.42
Japan:								
1974		(12)		(55)		(33)	238,000	2.3
USA:								
1976		(19)		(68)		(13)	542,000	2.5

Source: MOST, 1981.

Industry's share of total scientists and engineers in R&D remained less than 30% of the total; by contrast, in industrialized countries, industry employs the largest number of scientists and engineers, almost 70% in the case of the United States.

2.16 The weakness of the R&D sector in Korea is also revealed by examining the average annual R&D spending per researcher. During 1976-79, industry's average R&D spending per researcher increased from about US$10,000 equivalent in 1976, to about US$16,000 equivalent in 1979, in constant 1976 prices, but this amount was still too small, even accounting for both the relatively low salary cost and the less advanced stage of industry in Korea, to undertake proper RD&E work. It has been estimated that spending levels between US$20,000 and US$30,000, in constant 1976 prices, per research scientist and engineer would not be unreasonable for Korea.1/

D. Industry's Technology Expenditures

2.17 Korea's initial industrialization was primarily directed and controlled by nationals and was based on foreign technologies that were mature and proven elsewhere. 2/ Those technologies were easily transferable with minimal in-house RD&E efforts by local recipients and were acquired from abroad primarily through means other than direct foreign investments. The predominant mode of technology transfer was through the import of capital

1/ Korea: Development of Machinery Industries (A Case Study in Strategy and Tactics). IBRD Report No. 2130-KO, March 19, 1979.

2/ Korean Industrial Competence: Where It Came From. IBRD Staff Working Paper No. 469, July 1981.

equipment and turnkey plant construction. Consequently, expenditures on foreign technical assistance, as well as engineering services, constituted a significant part of industry's technology expenditures.

2.18 Korean industry gradually acquired considerable technological and manufacturing know-how, through decades of manufacturing experience, reverse engineering, participation in turnkey plant construction, and numerous contacts with foreign capital equipment suppliers. Industry's steady accumulation of technological competence enabled companies not only to disassemble the packaged foreign technologies, but also to select the most appropriate technologies through licensing agreements. At the same time, as Korea gradually expanded into more skill and technology-intensive industries, such as shipbuilding, iron and steel manufacturing, electronics, and other machinery industries, licensing arrangements were often the most cost effective and time saving mode, if not the only mode feasible, for obtaining the necessary technological and manufacturing information.

2.19 With the growing technological sophistication of industry, and with industry's ambitious expansion program into a number of import substituting, technology-intensive heavy industries in recent years, royalty payments by industry increased dramatically, from less than US$2 million a year during the 1960's, to more than US$80 million a year during 1977-79 in current terms. In 1979, royalty payments accounted for close to 40% of industry's technology expenditures. The relative importance of in-house RD&E work was also gradually recognized by industry, in line with its growing technological competence, as well as the changing technological needs. Reported in-house R&D spending by industry was about US$110 million or 52% of its total technology expenditures in 1979. The growing importance of licensing arrangements and in-house RD&E work in Korea is shown below:

Korea - Industry's Technology Expenditures
(US$ million, in current prices)

	1969		1979	
	Amount	(%)	Amount	(%)
External Payments on:				
Technical Assistance & Engineering Services /a	3.7	40.2	17.4	8.3
License Fee & Royalty Payments /b	2.3	25.0	83.2	39.4
Subtotal	6.0	65.2	100.6	47.7
Internal Expenditures on:				
In-house RD&E Works /a	3.2	34.8	110.3	52.3
Total	9.2	100.0	210.9	100.0

Source: MOST, 1981.

/a By manufacturing sector alone.
/b Manufacturing sector accounts for 90% of the expenditures.

Korea - Industry's Royalty Payments and In-House RD&E Expenditures
(in current prices)

Royalty Payments:	Amount (US$ million)	As Percent of Export Value (%)
1971	5.6	0.58
1975	24.6	0.52
1976	27.9	0.39
1977	52.0	0.58
1978	74.0	0.67
1979	83.2	0.64

In-house R&D: /a	Amount (US$ million equivalent)	As Percent of GNP (%)
1971	3.5	0.04
1975	25.5	0.14
1976	31.3	0.12
1977	86.2	0.27
1978	111.2	0.23
1979	122.5	0.20

Source: MOST and EPB, 1981.

/a Manufacturing sector accounts for 90% of the expenditures.

2.20 Despite the large increase in absolute terms in industrial technology expenditures over the past decade, Korea today still lags behind Japan in technology expenditures compared to Japan at a similar stage of economic development. When Japan's exports exceeded US$10 billion, its royalty payments were about 2.3% of the export value, as compared to 0.64% in 1979 in Korea. When Japan's per capita income was about US$1,600 in constant 1979 prices, its in-house R&D expenditures totalled about 0.66% of GNP, as compared to 0.2% of GNP in 1979 in Korea.

E. Government's R&D Policy

2.21 The Government's strategy to upgrade manufacturing sector's technological capability is basically a three-pronged approach: (i) promotion of foreign technology imports; (ii) encouragement of industry's in-house RD&E activities; and (iii) establishment of R&D infrastructure, specifically public research institutes, to serve industry. Further, to facilitate the efficient execution of this strategy, the Government has increased educational sector investments to improve the quantity, as well as the quality of the technical manpower supply (technicians, engineers, and scientists) to industry.

1. Measures to Promote Foreign Technology Imports and RD&E Work by Industry.

2.22 The measures that the Government has taken to promote foreign technology imports and industry's in-house R&D efforts, generally fall under three categories: (a) administrative measures to reduce Government control on foreign technology acquisition; (b) fiscal incentives to reduce the cost of in-house RD&E work; and (c) financial incentives to provide funds for RD&E undertaking and technology imports by industry.

2.23 Administrative Measures. Within a brief period (1978-80), the Government virtually eliminated all restrictions on the importation of foreign technologies. In addition, the Foreign Investment Inducement Act was amended in 1980 to increase the inflow of direct foreign investment and technology.

2.24 Fiscal Incentives. The Technology Promotion Law (No. 2399), which was promulgated in December 1972 and amended in December 1977, provides a framework for various incentives to promote the development and upgrading of industry's technological capability. These incentives are aimed at reducing the costs of foreign technology imports and of industry's RD&E work, by allowing reduced tariffs on the import of R&D equipment; deduction of annual non-capital RD&E expenditures from taxable income; accelerated depreciation on industrial RD&E facilities; and a tax credit (8-10%) for investment in facilities for RD&E work or for commercialization of locally developed R&D results.

2.25 The Technology Promotion Law also introduced a tax reducing scheme, called the Technology Development Reserve (TDR). Under this scheme, and as provided in the Tax Reduction Act, a company can set aside up to 20% of profit before tax, in any one year, if it submits to and obtains from MOST approval of its RD&E program for the following two years. In effect, the TDR scheme allows companies to write off RD&E expenditures as early as two years before actual expenditures are incurred. However, if TDR funds so accumulated are not used within two years, the company must pay back-tax on the unused balance, as well as a penalty on the back-tax. Annual TDR accumulation by manufacturing companies increased from about Won 3 billion in 1974, to Won 28 billion in 1979, and, the number of companies participating in this scheme doubled in six years, from 60 companies in 1974, to 126 companies in 1979, as shown below:

Korea - Technology Development Reserve

	No. of Companies with TDR Account	Annual Accumulation (Won billion)
1974	60	2.9
1975	67	4.5
1976	49	5.8
1977	71	8.3
1978	149	30.4
1979	126	28.3

Source: MOST, 1981.

2.26 Financial Incentives. Since 1976, the Government has experimented with the idea of expanding the scope of the Government-owned Korea Development Bank (KDB) to provide funds for the commercialization of locally developed R&D results, and purchase of R&D equipment, through "Technology Development Loans." KDB normally accepts applications for Technology Development Loans only for one month a year, in February, and after due consultations with MOST regarding the technological aspects of the projects, KDB grants approval in the following June. Despite the severe time constraint imposed on the submission of loan applications, the Technology Development Loan applications more than doubled in less than two years, from US$12 million equivalent in 1977, to US$29 million equivalent in 1979. However, actual loans made by KDB declined from US$9.5 million equivalent in 1977, to US$8.5 million in 1980, as shown below:

Korea - KDB's Technology Development Loans
(US$ million equivalent, in current prices)

	Loan Applications	Loans Approved
1977	12.4	9.5
1978	20.2	10.3
1979	29.3	7.2
1980	27.3	8.5

Source: Korea Development Bank (KDB), 1981.

2.27 KDB's Technology Development Loans, which have accounted for less than 0.5% of its annual lending, can be made only for hardware and must have collateral backing. Furthermore, KDB has limited capability in appraising technology-intensive projects. Consequently, KDB's role in financing R&D and the commercialization of locally developed R&D results has had, and is likely to continue to have, limited impact on local R&D efforts.

2. Public Research Institutes

2.28 In 1966, the Government established the Korea Institute of Science and Technology (KIST), a multi-disciplinary research institute, to perform industry-oriented RD&E activities. During 1976-78, in view of the expected growing demand for technological services by industry in connection with its gradual transformation into a higher skill- and technology-intensive one, the Government established some 15 additional public research institutes (para. 2.11) to complement the functions of the existing institutes. These institutes, many of which are spin-offs of KIST, specialize in individual target industrial subsectors. Unlike KIST, which was under the responsibility of MOST, these institutes were placed under relevant operating ministries with a view to promoting a close link with the respective industries. As is shown in the table in para. 2.12, public research institutes as a whole spent about Won 50 billion (US$105 million equivalent) or 29% of Korea's total R&D spending in 1979; however, a good part of it is capital expenditures in connection with establishment of new institutes. Further, because the expansion program was

hastily organized and implemented, they often competed for the same limited technological manpower resources with industry, which was also building up in-house technological capabilities. In retrospect, too many public research institutes were established in too short a period of time.

2.29 Since these institutes recruited heavily from academic fields, they are particularly weak in manufacturing know-how and the development of prototypes, and could not compete with foreign licensors in supplying the detailed blueprints and other manufacturing know-how as well as in assisting industry to solve teething problems in the crucial initial production stage. As such, their work tends to be too theoretical to serve industry effectively. The weak link between industry and public research institutes is best illustrated by the volume of industry's contracts with these institutes. In 1978, out of industry's total R&D expenditure of Won 55.8 billion (US$115 million equivalent), only Won 2.3 billion (US$4.7 million equivalent), or 4% of the total, was contracted out to these institutes.

2.30 In a major departure from the nature and activities of other public research institutes, KIET was established as an RD&E-cum-service organization to support the electronics industry. KIET was designed to provide industry with services relating to: (i) acquisition and development of products or processes to enable industry to advance to new areas; and (ii) provision of production support and back-up services, such as product custom design, supply of process inputs, testing and quality control, equipment services and training. Under the Electronics Technology Project (para. 1.08), which is nearing completion, KIET is equipped with the facilities and capabilities to service the electronics industry across the entire spectrum of the product life cycle, from research and development to production, and is provided with funds to finance RD&E projects sponsored by industry but carried out at KIET. Since KIET's RD&E work is done on facilities that can also be used for production purposes, the manufacturing know-how will be readily transferable to industry.

2.31 In December 1980, in order to form an effective critical mass, and to avoid the pitfalls of spreading limited resources too thin, the Government merged closely related public research institutes, reducing the number from 19 to 13, and consolidated the administrative responsibilities under MOST, as shown in Annex 2-2. This consolidation of public research institutes under one ministry should improve the coordination among these institutes, but, at the same time, may dilute their linkage to industry.

2.32 The Government is currently formulating policy measures to promote closer cooperation between public research institutes and industry. According to the preliminary R&D sector program, during the Fifth Five-Year Plan (1982-86), the Government (MOST) would commission the public research institutes to carry out "national projects" (shown in Annex 2-3) to develop, jointly with industry, technologies in areas of critical importance to future growth, such as semiconductors, computers, fine chemicals, automobiles, nuclear engineering, and industrial systems engineering.

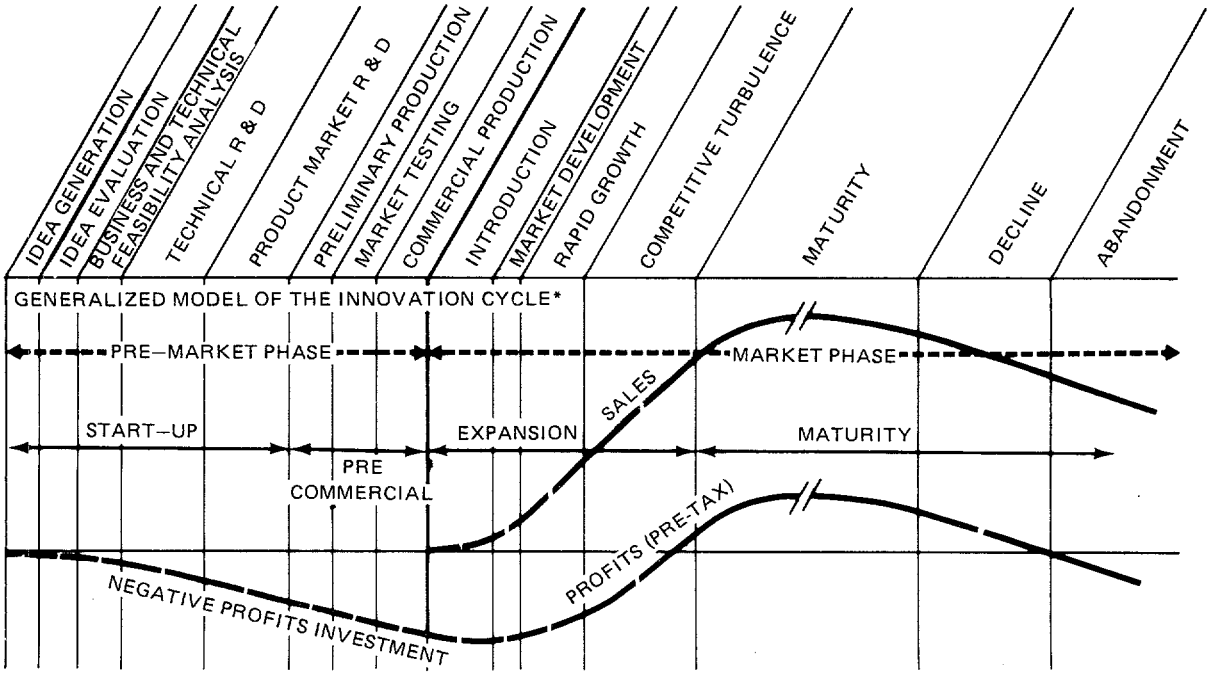
2.33 Although it is too early at this stage to assess how successful "national projects" will be in promoting a closer link between public research institutes and industry, it is almost certain that other mechanisms will be called for if the link between industry and public research institutes is to be further developed. One such mechanism would be to channel a certain percentage of research institutes' annual budgets (shown in Annex 2-4) through intermediaries such as KTDC, which would then use the funds to finance a part of the cost of the RD&E projects from industrial companies to be contracted out to research institutes. With this funding arrangement, the research institutes collectively would not only regain all their budgetary funds diverted to KTDC, but also would stand to receive additional funds by virtue of the cost sharing required from industrial companies for their contract work. This arrangement would then not only mobilize additional resources for research institutes as a group, but would also introduce an element of competition among the various research institutes, as well as among the various units within each institute, and thus make them more responsive to the needs of industry. This arrangement is under consideration by the Government. The Government has agreed that it will exchange views with the Bank from time to time on the Government's industrial RD&E policies, especially with regard to the progress made towards a closer link between industry and the public research institutes and on the national projects, as well as other policies aimed at promoting and supporting the development of industry's RD&E capability.

F. RD&E Financing: An Institutional Gap in the Korean Capital Market

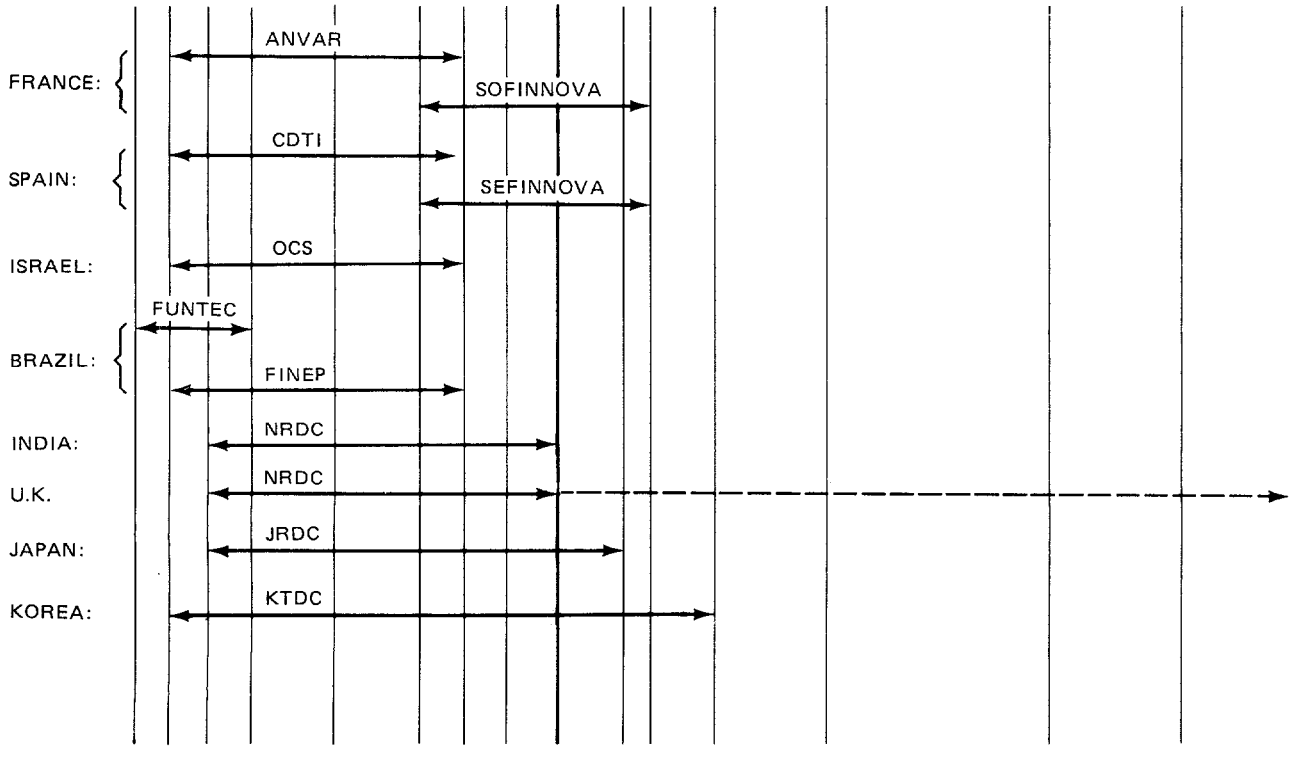
2.34 Industrial firms in Korea currently face unusual difficulty in raising funds for their technological capability development from existing financial institutions. To understand this institutional gap in the capital market, one needs to examine the various phases of the product life cycle (or product innovation cycle) and the range of financial support mechanisms for each of these phases. As illustrated in the chart on page 16, the product life cycle can be generally conceived as consisting of four phases: start-up; pre-commercial; expansion; and maturity. The first phase -- start-up -- comprises feasibility studies and technical R&D. The second phase -- pre-commercial -- involves construction of prototypes and pilot plants, preliminary production and test marketing. The third phase -- expansion -- consists of rapid expansion of production and sales if the new product is successful. In the fourth phase -- maturity -- sales grow in accordance with the state of the economy and market conditions.

2.35 Each of the four phases of the product life cycle is associated with a typical financing pattern. In the first phase, the newly launched entrepreneur usually draws on private funding sources, i.e., his own savings and borrowings from family and friends; the ongoing firm draws on internally generated funds, Government RD&E grants and long-term loans, venture capital, etc. In the second phase, funds are drawn substantially from the same sources as in the first phase, with greater emphasis on venture capital and less concessionary Government financing or subsidies. The third and fourth phases -- which constitute the market phase of the product life cycle -- are normally

KOREA – MODEL OF THE PRODUCT LIFE CYCLE (INNOVATION PROCESS)



INTERVENTION PERIOD OF INNOVATION SUPPORT ORGANIZATIONS



Source: Udell, Gerald G., "Public Law and Technological Innovation," unpublished paper, the Experimental Center for the Advancement of Invention and Innovation, University of Oregon, October 1977.

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financed by self-generated funds, investment and commercial banks, supplemented if necessary by Government incentives such as preferential interest rates and tax incentives.

2.36 In the Korean situation, the focus of industrial development has been on the market phase of the product life cycle. This has been appropriate for a developing country which could rely on imported, fairly proven, standard technologies that can be easily assimilated. Commercial, investment and development banks (DFCs), and a fast developing securities market provide the financial intermediary services useful at the expansion and maturity phases of the product life-cycle. But these services are inadequate at the start-up and pre-commercial phases, namely the pre-market phase, where Korea needs to develop capacity, as a necessary condition of its accelerated technological development. The risky character of projects at the pre-market phase (RD&E projects) makes conventional loans unattractive both to lenders and borrowers: lenders prefer less risky projects; and borrowers prefer to restrict their activities to what could be self-financed so as not to incur debts that would be difficult to discharge in the event of project failure.

2.37 The foregoing discussions (paras. 2.34 to 2.36) indicate that new financing instruments of risk-sharing nature should be made available to promote and accelerate industry's undertaking of RD&E activities.

G. KTDC and Its Relationships With Other Industry Support Organizations

2.38 KTDC was established in 1981, as a private sector entity with strong private sector support, to fill the institutional gap in the Korean capital market (paras. 2.34 to 2.37). Thus, KTDC's objective is to accelerate advanced foreign technology imports and in-house R&D work (para. 2.21) through the provision of funds, that are not available from other financial institutions in Korea, due to the software-intensive and/or risky nature of such projects. Further, KTDC will also help strengthen the link between public research institutes and industry through its financing of RD&E projects sponsored by industry but carried out by the institutes.

2 39 KTDC will complement the activities of existing financial institutions, as well as those of other industry support organizations, including KTAC and KOPTEC, which are being considered for Bank Group assistance (para. 1.08). KTAC was incorporated in 1974 as a wholly-owned subsidiary of KIST, now (since the December 1980 reorganization) the Korea Advanced Institute of Science and Technology (KAIST), an institute of technology-cum-RD&E institution, with the primary objective of commercializing production technologies (products and processes) developed by KAIST. To this end, it was set up to prepare detailed feasibility studies for selected projects with strong commercial potential based on the results of KAIST's RD&E efforts, and to approach interested parties to sell such projects for a commission. It will also make equity investments in such projects. During the last 7 years, KTAC has made 11 sales of know-how and 5 equity investments, with its total assets amounting to

Won 0.9 billion (US$1.3 million equivalent) at the end of 1980. It is currently seeking to increase its share capital by about Won 1.3 billion (US$1.8 million equivalent), including a proposed equity investment of Won 500 million (US$690,000 equivalent) by the IFC, which would be needed for initiating some 11 projects through the end of 1984.

2.40 In contrasting the areas of emphasis of KTAC and KTDC, it can be seen from the foregoing discussions that (i) while the emphasis of KTAC's operations lies in the production/prototype stage of the product life cycle, which is generally characteristic of venture capital-type companies such as SOFINNOVA (France) and SEFINNOVA (Spain) as illustrated by the chart on page 16, the thrust of KTDC is much further upstream and covers practically the entire range of the pre-market phase of the product cycle beginning at the "idea evaluation" stage; and (ii) while KTAC primarily seeks to commercialize RD&E results achieved by a public research institute (KAIST), KTDC will attempt mainly to assist industry to commercialize the results of their RD&E efforts. In fact, in some cases, it is expected that KTDC will participate in the projects promoted by KTAC. Further, since only 10% of KTDC's resources are targeted for equity investment and, with a view to promote and broaden the venture capital market in Korea, KTDC will eventually seek to assist in setting up other venture capital companies such as KTAC. Such venture capital companies would serve to commercialize primarily technologies developed by industry.

2.41 KOPTEC was created in January 1981 as an autonomous entity under the Ministry of Commerce and Industry (MCI) to provide shop-floor advice and guidance to upgrade technical capabilities and productivity of small and medium machinery enterprises, as well as enterprises in other key export subsectors. KOPTEC complements the activities and functions of the Small and Medium Industry Promotion Corporation (SMIPC) in the provision of extension services, training and technical information to small and medium industries. KOPTEC is a technical assistance organization, whose activities will be concentrated primarily in the market phase of the product life cycle and where the production technologies involved are relatively mature. It is expected that, in the course of its operations, KOPTEC will refer those of its clients with promising RD&E projects to KTDC, and that KTDC will reciprocate by encouraging its clients to seek guidance from KOPTEC in improving their production practices.

2.42 As discussed in the above paragraphs, although KTDC, KTAC, and KOPTEC are all involved in promoting and supporting the enhancement of the technical level of Korean industry, each organization has a different area of emphasis, with KTDC at the upstream, KTAC at the midstream and KOPTEC at the downstream of the product life cycle. Bank Group assistance to these organizations represents a major effort in promoting and advancing technological development of industry in Korea.

III. THE KOREA TECHNOLOGY DEVELOPMENT CORPORATION (KTDC)

A. Legal Framework and Ownership

3.01 KTDC was established under the Korea Technology Development Corporation Act (Law No. 3312) promulgated on December 31, 1980, and the associated Enforcement Decree (Presidential Decree No. 10292) issued on April 22, 1981. This special KTDC Act and the associated Presidential Decree, which were framed following extensive discussions with the Bank, will enable KTDC to operate in an autonomous manner with the efficiency of a private company; to have a strong and independent management; and to have the ability and means to attract and retain staff of high caliber and entrepreneurship. All these factors are most critical to the success of an operation of KTDC's type. Public interest in KTDC, by way of Government financial support, such as equity contributions, soft loans, loan guarantees, etc., as elaborated in section H below, will be safeguarded principally through Government representation on KTDC's Board of Directors, exercising the usual right of a shareholder. Also, to prevent KTDC from being dominated by any one private shareholder, the KTDC Act stipulates that the ownership of any shareholder, with the exception of the Government and official international development financing institutions, will be limited to no more than 7% of the total shares issued, and that in case any such shareholder's shares should exceed 7% of the total shares issued, his voting rights would be limited to 7%.

3.02 KTDC has an authorized capital of Won 15 billion (US$21 million equivalent), to be issued in 15 million shares with a par value of Won 1,000 each. To raise this authorized capital, it is intended that Won 9 billion (60%) will be subscribed by the private sector, and the balance of Won 6 billion (40%) by the Government. The initial paid-in capital at the time of incorporation of KTDC in April 1981 was Won 7.5 billion, or 50% of the authorized capital. As shown by the list of shareholders given in Annex 3-1, the ownership is broad-based, including the participation of 13 industrial groups, 83 individual firms, and 5 banking institutions.

3.03 The status with regard to the raising of KTDC's share capital is summarized below:

KTDC - Share Capital

	Paid-in Capital as of 4/28/81		Additional Subscriptions by 12/31/84		Total Paid-in Capital as of 12/31/84	
	Won Million	(%)	Won Million	(%)	Won Million	(%)
Private Firms	5,552.7	73.6	) 2,447.3	33.0	) 9,000.0	60.0
Banking Institutions	1,000.0	13.2	)		)	
Government	1,000.0	13.2	5,000.0	67.0	6,000.0	40.0
Total	7,552.7	100.0	7,447.3	100.0	15,000.0	100.0

3.04 It is noted from the table in para. 3.03 that: (i) of the paid-in capital of Won 7.5 billion as of April 28, 1981, the Government provided only Won 1 billion, or 13.2%, while private firms and banking institutions together contributed Won 6.5 billion, or 86.8% of the total; and (ii) with regard to new subscriptions up through 1984, the Government is committed to provide Won 5 billion, and the private sector to raise about Won 2.5 billion. Since these new subscriptions will be required for KTDC to finance its operations, the Government has agreed to contribute the additional Won 5 billion during 1982-84. Also, KTDC has agreed to raise additional equity from the private sector of at least Won 2.5 billion during 1982-84.

B. Role of KTDC

3.05 The principal role of KTDC will be to promote and facilitate the technological development of Korean industry. In this connection, it will actively identify and appraise RD&E projects initiated by industry with a view to providing financial support for such projects. KTDC will put strong emphasis on sharing the risks with project sponsors and thereby will influence and reinforce industry's attitude towards further undertaking of RD&E activities. The financial support provided by KTDC will basically serve as "seed money", which should have a multiplier effect on industry's RD&E investment necessary for the accelerated development of industrial technological capability. In addition, with its firsthand knowledge of the status of technological development and needs of industry, through direct contact at firm level and through periodic surveys by KTDC staff and consultants, KTDC will be in a good position to assist industry to identify international technological trends and areas in which it should focus its RD&E efforts. Also, through the process of appraising and particularly supervising its RD&E projects, KTDC will induce a measure of discipline, and hence increase the efficiency in industry's management and implementation of RD&E activities. Finally, KTDC will promote a closer link between industry and public research institutes, by encouraging and financing projects sponsored by industry and carried out by these research institutes.

C. KTDC's Functions and Financing Instruments

3.06 KTDC will seek to promote, appraise and finance mainly the following types of projects:

(a) Projects for RD&E through:

  (i) industry's in-house RD&E facilities and projects; and

  (ii) industry's RD&E contracts with public research institutes;

(b) Projects for the introduction and adaptation of advanced technology in terms of:

(i) costs of technology search and selection;

(ii) technology transfer fees; and

(c) Projects for the improvement of manufacturing capabilities, products and processes in the form of:

(i) technical assistance and consulting fees; and

(ii) costs of specialized training, domestic or overseas;

(d) Projects for the commercial exploitation of RD&E results where financing is not available from other financial institutions; and

(e) Projects for the development and improvement of the capabilities of the technical consulting and engineering services industry in Korea.

3.07 The types of projects assisted by KTDC, as enumerated in para. 3.06, will involve expenditures for hardware, such as equipment and machinery for RD&E purposes, and software, such as technical know-how, expert consulting services and manpower training, as well as consumable materials and supplies for RD&E activities, such as for the development of prototypes and pilot plants.

3.08 To promote the undertaking of RD&E projects by industry, which inherently involve substantial risks coupled with expected high returns, KTDC will have to share both the risk of failure and the benefits of success. To this end, KTDC will offer the following types of financial support:

(a) Conventional loans: regular loans to be repaid according to certain predetermined conditions (interest rate, grace period, repayment period);

(b) Conditional loans: financial instruments that allow profit and risk sharing with project sponsors. Such "loans" will normally be "repaid" through royalty payments from sales revenues if the project is successful, including a reasonable return on the loans. If the project does not result in sales revenues, KTDC will recover only a portion of the principal from the sponsor. KTDC has agreed that the stipulated royalty payments would be enough at least to provide for repayment of the principal amount of the loan plus interest and other charges at the same rate as applies to conventional loans. It is expected that, through negotiations with the prospective subborrower, the royalty payments will be set higher than this minimum in order to compensate KTDC for the risk associated with this type of operation; 1/

(c) Equity investments: equity participation in companies set up to commercialize RD&E results; and

(d) Mixtures of the above.

1/ For the purpose of financial projections, average expected royalties equivalent to a 10% return in real terms have been assumed (para 3.32).

3.09 KTDC's conventional loans may be granted with or without collateral requirement depending on the nature of the projects and sponsors. Conventional loans without collateral security are particularly appropriate in the case of software-intensive projects to be carried out by sponsors who can least afford to provide security, such as small-scale industrial firms. Since KTDC's financing is oriented towards the risk sharing, venture capital type, KTDC will emphasize software loans without collateral, rather than hardware loans with collateral security, as financing for the latter may be available from other financial institutions.

3.10 With regard to conditional loans, KTDC intends to require sub-borrowers to repay a certain portion, called a "minimum royalty payment", of up to 30% of its contribution, regardless of the outcome of their projects. The failure rate on conditional loans is not expected to be higher than 25-30% 1/, because RD&E activities by Korean industry are mostly directed towards development and engineering in relatively known fields. The minimum royalty payment requirement, in addition to minimizing KTDC's risk exposure on its conditional loan portfolio, should have the desired effect of encouraging efficiency in project implementation by the sponsor. Although the exact amount of the minimum royalty payment would have to be negotiated with project sponsors on a case-by-case basis, KTDC will consider waiving this requirement altogether for eligible projects from small scale industrial firms.

D. Organization, Management and Staff

3.11 Under its Charter (Law No. 3312), the responsibility for the policy and general direction of KTDC's business is vested in a Board of Directors, consisting of not more than 12 members elected for three-year terms by the General Shareholders' Meeting. The Directors need not be shareholders of KTDC. The Shareholders' Meeting for KTDC's inauguration in April 1981 elected 10 Board members, including a Vice-Minister of MOST, 7 prominent industry and business leaders (including the Chairman of AIRI and the Chairman of the Korea Federation of Small Business (KFSB)), and 2 Directors who serve as Representative Director and President (President) and Executive Vice-President of KTDC. The President of KTDC reports directly to the Board, and is responsible for the overall as well as day-to-day operations of the Corporation.

3.12 The Chairman of the Board, Mr. J.Y. Chung, who is also Chairman of FKI as well as the Hyundai Group, is a leading industrialist in Korea. Mr. I.S. Kim, formerly the Executive Vice-Chairman of FKI, was elected as President of KTDC. Mr. Kim is a dynamic and capable administrator with a sense of mission. With his deep knowledge of Korean industry and business, acquired during his ten-year tenure as Executive Vice-Chairman of FKI, Mr. Kim is expected to provide the leadership necessary to launch and establish KDTC successfully. Mr. C.D. Kim, a highly competent manager with extensive banking experiences, was elected Executive Vice-President. The composition of the Board of Directors is given in Annex 3-2.

3.13 As provided in the KTDC Act, the Shareholders' Meeting also appointed, with the required approval of the Minister of MOST, an Auditor for a

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1/ Based on the experience in other countries, a failure rate of 30% (in commercialization) has been assumed for the purpose of financial projections (para. 3.32).

two-year term. The Auditor, who is responsible for auditing and examining the operations of KTDC, is a non-voting participant at Board meetings. KTDC has also appointed a Technology Review and Advisory Committee to advise on matters related to its business activities. Members of this Committee have broad knowledge and experience in the technology development field and are drawn from various sectors, including Government, research institutes, industry and universities. KTDC has also enlisted a high-level and prestigious group of advisors (Annex 3-2) for consultation, on an ad hoc basis, on issues concerning the overall direction and strategy for its operations.

3.14 While the Board has ultimate authority over all investment decisions, it has delegated authority to the President to approve individual loans and investments up to Won 300 million (US$0.42 million equivalent), and to an Executive Directors' Committee, which includes all executive directors 1/ and is chaired by the President, to approve individual loans and investments up to the ceiling of Won 500 million (US$0.7 million equivalent). Such an arrangement strengthens the hands of the President and the management of KTDC, and will make the decision process within KTDC more efficient.

3.15 In the management of KTDC, Mr. Kim is also assisted by two capable Directors in charge of four Departments of the Corporation. As shown in the organization chart in Annex 3-3, KTDC's four departments are: Appraisal Departments I and II, which are divided along subsectors and responsible for project identification, appraisal and supervision; the Credit Department which handles the administration of loans and investments; and the Planning and Administration Department, which is responsible for planning and budgeting, economic and market surveys, accounting and control, personnel and other support services. At the time of appraisal, KTDC had recruited 30 professional staff, with various backgrounds, including RD&E engineers, project engineers, development banking officers and, investment officers, with 7-8 years of work experience on average. This professional staff, which is drawn mainly from the staff of leading industrial and banking institutions in Korea, is capable and eager, and should be able to acquire the additional skill and expertise, peculiar to KTDC's type of operations within a reasonably short period of time on the job. KTDC is expected to recruit some 20 additional professional staff during 1982-84, to handle its increasing volume of operations.

E. Expert Advisory Services and Training

3.16 Although KTDC's professional staff is capable of handling conventional loan operations, they will need from time to time coaching assistance from advisory experts, especially in appraising and negotiating those projects for which conditional loans are considered. In addition, such specialists are also expected to assist KTDC, during its initial stage of operations, in streamlining and fine-tuning its internal organization and procedures, as well as in training appraisal officers. Provisions for such advisory services are included in the proposed project. KTDC has agreed to contract experts for such services on a retainer or ad hoc basis at least until December 31, 1984, on terms and conditions acceptable to the Bank.

1/ Board Directors who are full-time managers of KTDC.

3.17 In addition to the on-the-job training rendered by the experts referred to in para. 3.16, KTDC plans to provide its staff with: (i) in-house training, including lectures and seminars to be given by local and foreign experts particularly those from institutions elsewhere in the world that are of similar nature to KTDC 1/; (ii) training at Korean academic institutions and professional associations through part-time courses; and (iii) overseas training at the institutions referred to in (i) and elsewhere. KTDC is already taking steps to contact its foreign counterparts with a view to exchanging information and experience and arranging suitable training and expert invitation programs with these institutions. KTDC has agreed that it will submit to the Bank by September 1, 1982, details of its proposed training and expert invitation program.

F. Operating Policies and Procedures

1. Operating Policies

3.18 KTDC's Statement of Investment and Operational Policies (Annex 3-4), which was approved by its Board of Directors on May 25, 1981, provides appropriate guidelines for its operations including the scope of investment activities, overall basis for investment decisions, assets diversification, relationship with clients, profits and reserves, etc. With respect to assets diversification, KTDC will not extend excessive investments and/or loans to the same business group. KTDC will normally not extend loans and/or investments to a single project totalling more than Won 500 million (US$0.7 million equivalent); assistance exceeding this amount will require a resolution of the Board of Directors. Also, KTDC's equity investment in any single enterprise will be limited to not more than 10% of its paid-in share capital and free reserves. To further ensure widespread financial assistance from KTDC, KTDC will limit its total financial commitment outstanding at any time to any single enterprise or business group to not more than 7% of its long-term portfolio or Won 4.2 billion (corresponding to about 7% of KTDC's capitalization during 1981-84), whichever is larger. Details of the terms and conditions of KTDC's loan and equity investments are given in the Statement of Rules on Lending and Equity Participation, shown in Annex 3-5.

3.19 Although the Statement of Investment and Operational Policies adequately defines the range of financing instruments that KTDC may provide, it should be emphasized that KTDC will strive to gradually expand its conditional lending and equity financing operations to promote and support risky RD&E projects. The following financing targets have been discussed with KTDC:

1/ Such as National Research and Development Corporation (NRDC)/UK; NRDC/India; Japan Research and Development Corporation (JRDC)/Japan; Centro Para El Desarrollo Technologico Industrial (CDTI)/Spain; the Office of the Chief Scientist (OCS)/Israel; Agence Nationale de Valorisation de la Recherche (ANVAR)/France; Deutsche Wagnisfinanzierungs-Gesellschaft (WFG)/Federal Republic of Germany; the Finnish National Fund for Research and Development (SITRA)/Finland; the National Swedish Board for Technical Development (STU)/Sweden; the Agency for Financing Studies and Projects (FINEP)/Brazil.

KTDC - Targeted Financing Instruments as a Percentage of Total Approvals

Year	1981	1982	1983	1984	1990
Conventional Loans	95	80	70	60	40
Conditional Loans	5	15	25	30	50
Equity Investments	0	5	5	10	10
Total	100	100	100	100	100

It is noted from the above table that KTDC's operations are directed towards conventional and conditional lending, whereas organizations of similar nature in other countries channeled their resources through conditional loans and grants. This difference in emphasis can be explained mainly by the relatively early stage of technological development of Korean industry, where acquisition of R&D infrastructure and foreign technologies still plays a relatively more important role than in more advanced countries. Furthermore, while organizations in other countries are funded almost entirely by governments, a considerable portion of KTDC's resources come from the private sector (para. 3.03). For these reasons, the above targets for the composition of KTDC financing operations are considered reasonable. The targets during 1982-84 have been specified in an amendment to the Policy Statement. It should be noted, however, that these targets are indicative and that they would have to be reviewed from time to time, taking into consideration the experience and actual results of KTDC's operations. Consequently, KTDC has agreed to review with the Bank by the end of each year beginning in 1982 the operational targets to be met by KTDC during the following year, and, on the basis of such reviews, adopt such targets as shall be mutually acceptable to KTDC and the Bank.

3.20 Under its Charter, KTDC is required to give priority support to Small and Medium Scale Industries (SMI) by allocating not less than a certain prescribed portion of its total financial resources to such enterprises as decided upon by its Board of Directors. KTDC is already committed to allocate to SMI at least 20% of its total financing in 1981, and plans to increase the SMI's share to 20% in 1982 and 30% in 1983-85. These targets for SMI's share have been specified in an amendment to the Policy Statement. SMI's share of KTDC financing may eventually be higher, since the SMI sector is expected to be the main beneficiary of KTDC's conditional loans and equity investments, for which a combined target of 40% has been set for 1984-85 (para. 3.19). KTDC has already taken major steps to promote its business and attract project proposals from SMI through seminars and direct contact with various SMI cooperatives, and is mounting a concerted plan for this purpose with the assistance of other SMI-support institutions such as SMIB, SMIPC, KOPTEC and KTAC.

2. Operating Procedures

3.21 In preparing for the establishment of KTDC, UNDP-financed consultants were employed during December 1980 - March 1981, with the Bank

acting as the Executing Agency, to assist in drafting detailed operating procedures for KTDC, which include mainly the Procedures Manual and the Appraisal Manual. The Procedures Manual gives details of the procedures and forms to be followed and filled out from the first approach of a client to KTDC, through the stages where the project is processed, appraised, and considered by KTDC, to the follow-up stages. The Appraisal Manual provides KTDC staff with a tool for project evaluation. KTDC's indicative guidelines for sub-project financing and the procedures for processing of sub-projects are shown in the charts in Annexes 3-6 and 3-7. These manuals, which are satisfactory, are essential for KTDC to conduct its operations; nonetheless, it is expected that modifications will be required from time to time as KTDC staff becomes more familiar with the operating procedures of the Corporation.

G. Accounts and Audit

3.22 KTDC will maintain its accounts in accordance with generally accepted accounting principles and practices, including separate accounts for expenditures for which withdrawals from the proposed Bank loan are requested on the basis of statement of expenditures (para. 4.10). KTDC has agreed that it will submit to the Bank its annual accounts, audited by external auditors satisfactory to the Bank, together with the auditors' report within 4 months after the close of each year, beginning with the 1981 accounts.

H. Financial Aspects

1. Financing Requirements

3.23 Based on various surveys of industry's RD&E capacity and project pipelines made by KTDC in late 1980, and some 100 applications that KTDC received during the first half-year of operations, as well as its anticipated project processing capacity, KTDC expects to process about 25 sub-projects in 1981, 90 in 1982, 125 in 1983, and 150 in 1984. Thereafter, it expects to increase its sub-project processing by about 10% annually. The aforementioned surveys indicate also that the cost of individual sub-projects contemplated by industry varies from about Won 7 million (US$10,000 equivalent) to more than Won 2.7 billion (US$4 million equivalent), with an average of about Won 200 million (US$300,000 equivalent). Based on the assumptions that (i) the average sub-project cost would increase annually by about 5% in real terms as industry accumulates experience with RD&E ventures; and (ii) KTDC would finance about 70% of sub-project cost, with the remaining 30% self-financed, on the average, KTDC's sub-project approvals and financing requirements on a commitment basis would be as follows:

KTDC - Projected Subproject Approvals and Financing Requirements, 1981-90

Year	Number of Subprojects	Average Cost per Subproject (Won million)	Total Cost (Won billion)	KTDC's Financing (Won billion)
1981/a	25	200	5.0	3.5
1982	90	224	20.2	14.2
1983	125	235	29.4	20.6
1984	150	247	37.0	26.0
Subtotal 1981-84	390	235	91.6	64.3 (90.0) /b
1985	165	260	42.9	30.0
1986	182	273	49.7	34.8
1987	199	285	56.7	39.7
1988	220	300	66.0	46.2
1989	241	315	75.9	53.0
1990	265	331	87.7	61.5
Total 1981-90	1,662	283	470.5	329.5 (458.0) /b

/a KTDC's initial half-year of operations.
/b US$ million equivalent.

3.24 The figures in the above table should be taken as indicative of the order of magnitude of KTDC's operations, since external financing of RD&E subprojects originating from industry is a new phenomenon in Korea and, therefore, there are many uncertainties surrounding these estimates. Nevertheless, KTDC's estimates are based on the best information available from questionnaires sent to a representative sample of industrial firms as well as through direct interviews with industry during its aforementioned surveys, and a realistic assessment of the Corporation's processing capacity. According to these estimates, KTDC's financing requirements for 1981-84 would be about Won 64-66 billion (US$90-92 million equivalent) for about 390 subprojects, of which 50-60% (about US$50 million equivalent) is expected to be in foreign exchange. This amount would represent about 15% of the total RD&E investments by industry during this period, assuming that the 1979 level of RD&E expenditures (para. 2.19) is maintained in real terms.

2. KTDC's Initial Capitalization

3.25 To meet this estimated financing requirement of about Won 66 billion (US$92 million equivalent) for 1981-84, KTDC would contract Government loans totalling Won 6 billion and float Government guaranteed bonds totalling Won 9 billion, for which the Government has committed to pay the differential between the interest rates KTDC would pay on its bonds and the interest rates of Government loans, in addition to the US$50 million loan (Won 36 billion equivalent) requested from the Bank and its Won 15 billion (US$21 million equivalent) equity funds to be raised during this period, (para. 3.03). The initial financing plan, that has been adopted for KTDC, is as follows:

KTDC - Initial Financing Plan

	1981 (Actual)	1982 (Won billion)	1983	1984	Total (1981-84) Won billion	US$ million /a	%
Equity:							
Private	6.5	1.5	1.0	-	9.0	12.5	14
Government	1.0	1.0	2.0	2.0	6.0	8.5	9
Total Equity	7.5	2.5	3.0	2.0	15.0	21.0	23
Debt:							
Government:							
Budget	1.0	1.5	1.5	2.0	6.0	8.5	9
Other /b	-	5.5	3.5	-	9.0	12.5	14
Total Government	1.0	7.0	5.0	2.0	15.0	21.0	23
IBRD /c	-	36.0	-	-	36.0	50.0	54
Total Debt	1.0	43.0	5.0	2.0	51.0	71.0	77
Total Financing	8.5	45.5	8.0	4.0	66.0	92.0	100

/a Figures are rounded.
/b Government guaranteed KTDC bonds.
/c Including 1.5% front end fee.

3.26 Of the total required local currency resources, other than equity funds, of Won 15 billion (para. 3.25), the Government already provided KTDC with a loan of Won 1.0 billion in 1981. The Government has agreed to provide or cause to be provided to KTDC by way of further loans and/or the purchase by the private sector of Government guaranteed KTDC bonds in aggregate amount of not less than Won 14 billion by December 31, 1984. This Won 14 billion will comprise Won 5 billion in direct Government loans and Won 9 billion in Government guaranteed bonds, which will be made available to KTDC during 1982-84 in accordance with the schedule shown in the above table. This schedule, which also includes Government's equity contribution each year during 1982-84, is satisfactory.

3.27 The terms and conditions of the Won 1 billion Government loan (para. 3.26) are not entirely suitable for KTDC's purposes. Specifically, the loan agreement: (i) imposes excessive restrictions and administrative burdens on the use of the funds by KTDC; (ii) imposes collateral requirements which imply that KTDC would not be able to use these funds for conditional loan operations; (iii) does not allow KTDC a sufficient margin to cover its risk (the maximum set at 2.5%); and (iv) does not provide for an adequately long repayment period (only 10 years is allowed). It has been confirmed that further Government funds would be lent to KTDC for 15 years including 5 years of grace to be on-lent by KTDC with a spread of 2.5% in the case of

conventional loans. In addition, the Government would not require that its funds be on-lent only to sub-borrowers capable of providing collateral and that the use of Government loan funds would involve only minimal administrative requirements on the part of KTDC. Furthermore, the Government will allocate budgetary resources, amounting to Won 250 million in 1982, Won 645 million in 1983 and Won 810 million in 1984, to pay the differential between the interest rates KTDC is expected to pay on its bonds and the interest rate KTDC pays on its loans from the Government. In addition, it has been confirmed that the remaining loan and equity funds as well as the interest differential funds for 1983 and 1984 are already included in Government's medium term budget for those years.

3. Other Government Support

3.28 Aside from its financial contribution to KTDC, in the forms of equity investments and loans, the Government also plans to provide KTDC with other support, including: (i) funds to cover KTDC's annual losses pertaining to its conditional loan operations during the initial years; (ii) revision of relevant tax laws to encourage industrial firms to invest funds accumulated in their Technology Development Reserve (para. 2.25) in KTDC; and (iii) tax incentives. These supports are discussed further in the following paragraphs.

3.29 To ensure that excessive concern with profitability and self-sufficiency would not prevent KTDC from fulfilling its promotional role effectively, the KTDC Act stipulates that the Government may provide KTDC with funds to cover losses on conditional loans on an annual basis. By comparison, most of KTDC's counterparts in the industrialized world are government-owned companies and, therefore, any losses that they incur are financed from government budgets. The Government has agreed to provide such supplemental financing for a limited period of time (5-7 years) in a manner satisfactory to the Bank. Since KTDC most likely will not receive such financial support until 4-5 years after KTDC's approval of such conditional loans as the support can only be provided for conditional loan losses as they are realized and because of the budgetary procedures for providing such funds to KTDC, the Government intends, in case of any shortfall in KTDC's cash flow during the initial period (4-5 years) of its operations, to provide additional funds as needed for KTDC to achieve its conditional lending targets.

3.30 With a view to encouraging RD&E activities undertaken by industry, the Government allows, under the Tax Reduction Act, industrial firms to reserve up to 20% of their profits before tax for utilization in such activities. However, the reserved funds, if not utilized within two years, would be subject to taxation at normal rates plus a penalty of 36.5% per annum on the back tax. To help KTDC in mobilizing its future equity funds, the Government has amended the Tax Reduction Act as of December 31, 1981, to waive the penalty tax should the firms opt to invest such reserved funds in KTDC's equity.

3.31 Tax legislation prior to project appraisal restricted the maximum tax allowance against bad debt to 1% of the loan portfolio outstanding at the end of the year in question. Since KTDC will finance high risk ventures (with a possible average failure rate as high as 25-30% for conditional loans as mentioned in para. 3.10), such tax system would overstate KTDC's income for

tax purposes during the initial years, and so tend to discourage the pursuit of risky activities by the Corporation. The Government has amended the Tax Reduction Act as of December 31, 1981, to allow KTDC higher allowance for bad debts in respect of its conditional loans (40% of conditional loans may be reserved for 4 years).

4. Financial Projections

3.32 KTDC's financial statements for 1981-90 have been projected based on the estimated volume of operations described in para. 3.23; the initial financing plan described in para. 3.25; and a gradual buildup of conditional lending from 5% of total approvals in 1981 to 50% in 1990 (para. 3.19). They are also based on the assumptions that: (i) conventional loans would be, on average, lent at 15.5% p.a. and repaid over 7 years including a 3-year grace period; (ii) conditional loans would earn average expected royalties totalling twice the amount of the loan over a 7-year period (equivalent to about 10% annual return in real terms), taking into account assumed sub-project failure rate of 30% (para. 3.10); and (iii) the Government would compensate for 50% of the losses on conditional loans, or 15% of the conditional loans granted by KTDC, for a limited period of 7 years. Other assumptions are given in Annex 3-8. Detailed fund raising plan and debt service, income statement, cash flow and balance sheet projections are given in Annexes 3-9, 3-10, 3-11, and 3-12. KTDC's projected financial performance and financial position are summarized in the following tables:

KTDC - Summary Projected Income Statements, 1981-90 /a
(Won billion)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Income From:										
Conventional Loans	0.3	1.4	3.4	5.6	7.5	9.0	10.1	11.0	12.0	13.1
Conditional Loans	0	0	0	0	0.3	2.1	5.8	13.2	20.5	31.5
Government Support for Conditional Loan Losses /b	0	0	0	0	0	0.2	0.5	1.0	1.4	1.8
Equity Investments	0	0	0	0	0	3.0	4.3	10.9	12.6	14.6
Interest on Liquid Holdings	0.5	1.0	1.2	0.7	0.5	0.7	0.8	0.9	1.0	1.5
Total	0.8	2.4	4.6	6.3	8.3	15.0	21.6	36.9	47.4	62.4
Expenses										
Financial Expenses	0.1	1.8	3.5	5.2	7.9	10.4	12.2	13.7	15.2	15.7
Salaries	0.1	0.4	0.7	0.9	1.1	1.4	1.8	2.2	2.6	3.1
Administrative and Others	0.3	0.8	1.3	1.7	1.9	2.3	2.7	3.3	3.9	4.6
Total	0.5	3.0	5.5	7.8	10.9	14.1	16.7	19.2	21.7	23.4
Income Before Tax	0.3	(0.6)	(0.9)	(1.5)	(2.7)	0.8	4.8	17.7	25.6	39.0
Income Tax	0.1	-	-	-	-	0.2	1.4	5.3	7.7	11.8
Income After Tax	0.2	(0.6)	(0.9)	(1.5)	(2.7)	0.5	3.4	12.4	17.9	27.2

/a Errors due to rounding.

/b Assuming that the Government compensates for 50% of conditional loans, or 15% of conditional loans granted by KTDC.

KTDC - Summary Projected Balance Sheets, 1981-90 /a
(Won billion)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Current Assets	6.6	10.3	10.6	5.9	11.8	17.8	19.6	23.8	29.4	31.6
(Of which: cash & liquid holdings)	(6.6)	(10.3)	(9.8)	(2.3)	(4.6)	(6.9)	(5.5)	(8.1)	(12.4)	(14.6)
Long-Term Portfolio										
Conventional Loans	1.7	9.0	21.0	32.0	40.6	46.3	50.5	54.8	59.8	66.6
Conditional Loans	0.1	1.2	4.9	11.3	20.5	32.4	46.2	61.8	79.3	99.3
Equity Investments	-	0.7	1.7	4.3	7.3	10.0	13.1	15.1	17.4	20.1
	1.8	10.9	27.5	47.7	68.4	88.8	109.7	131.6	156.5	186.0
Fixed and Other Assets	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2
Total Assets	8.7	21.6	38.4	53.9	80.5	107.0	129.6	155.7	186.1	217.8
Current Liabilities	-	-	-	-	0.1	4.8	5.3	5.5	7.0	7.0
Long-Term Liabilities	1.0	12.0	26.7	41.7	64.9	81.1	95.8	108.4	119.4	123.5
Equity										
Share Capital	7.5	10.0	13.0	15.0	21.0	26.0	30.0	31.0	31.0	31.0
Retained Earnings	0.2	(0.4)	(1.3)	(2.8)	(5.5)	(4.9)	(1.5)	10.8	28.7	56.3
	7.7	9.6	11.7	12.2	15.5	21.1	28.5	41.8	59.7	87.3
Total Liabilities and Equity	8.7	21.6	38.4	53.9	80.5	107.0	129.6	155.7	186.1	217.8
Debt/Equity Ratio	0.1	1.3	2.3	3.4	4.2	4.1	3.6	2.7	2.1	1.5
Debt Service Coverage (times)	1.6	-	-	-	0.2	0.9	1.0	1.7	2.0	2.5
Return on Equity (%)	2.3	-6.1	-7.6	-12.3	-17.0	2.5	11.8	29.5	29.9	31.1

/a Errors due to rounding.

3.33 The above tables indicate that KTDC would incur losses during 1982-85 totalling Won 5.7 billion, but would begin to earn profits thereafter, with net income after tax increasing from Won 0.5 billion in 1986 to Won 27.2 billion in 1990. Correspondingly, the return on equity would be negative, ranging up to -17.0% during 1982-85, and would increase from 2.5% in 1986 to 31.1% in 1990. The projected financial performance, although tentative, is typical of a risk-sharing operation such as KTDC's, mainly due to (i) the inherent risk of failure associated with RD&E projects; (ii) the time of 4-5 years for KTDC to build up a sufficiently large size portfolio of conditional loans and equity investments to diversify such risk; and (iii) the long gestation period (4-5 years) of conditional loans and equity investments, after which the successful ones would begin to yield profits.

3.34 To finance its operations beyond 1984 as indicated in para. 3.23, it is projected that KTDC would have to raise additional resources, including some Won 16 billion of equity and Won 73 billion in loans during 1985-88. These figures are tentative and will necessarily depend on the results of KTDC's operations during the initial three-year period. KTDC is not expected to have difficulty in raising these additional resources given the continued strong support of the private sector and the Government. Total assets would, consequently, increase from Won 54 billion at end-1984, to Won 218 billion at end-1990. As reflected by the financial performance set forth in para. 3.33, and the need to contract additional loans for its operations, KTDC's debt/equity ratio would increase to 4.2:1 in 1985; thereafter, it would gradually decline to 4.1:1 in 1986, 2.7:1 in 1988 and 1.5:1 in 1990. Although the projected debt-equity ratios are well within the 10:1 ceiling stated in KTDC's Statement of Investment and Operational Policies (Annex 3-4), KTDC has agreed that it would obtain the Bank's consent prior to contracting any long-term debt(s), if such debt(s) would cause its debt-equity ratio to exceed 4 to 1.

IV. PROJECT OBJECTIVES AND THE BANK LOAN

A. Project Objectives and Scope

4.01 The overall objective of the proposed project is to foster industrial technology development in Korea in order to accelerate the transformation of Korean industrial structure towards a technology-intensive one to achieve long-term economic growth. The project, through the establishment and development of KTDC, would promote and support the development of the technological capability of Korean industry by providing financial assistance in the forms that are suitable for typically risky and software-intensive industrial RD&E projects not available in the existing financial market; and induce a closer link between industry and public research institutes by encouraging RD&E projects sponsored by industry but carried out by those institutes. Further, through the successful operations of KTDC, the project should demonstrate not only the profitability of industrial RD&E undertakings, thereby stimulating and broadening the interest of Korean industry in embarking on such activities, but also the soundness of such a risk-sharing financing mechanism to the Korean capital market.

4.02 The proposed project consists of two components:

(a) Institutional Development of KTDC: The project would finance:

(i) consulting services to strengthen KTDC's capability in identifying, appraising, negotiating and supervising industrial RD&E projects, particularly those that qualify for conditional loans;

(ii) consulting services to assist KTDC in carrying out periodic studies and surveys of Korean industry's RD&E programs and their progress of implementation, as well as areas of potential development;

(iii) invitation of experts especially from other institutions in Bank member countries that are of similar nature to KTDC, such as those mentioned in para. 3.17, to exchange their working experience with KTDC;

(iv) training of KTDC staff at the institutions referred to in (iii) and elsewhere; and

(v) purchase of educational materials (books, periodicals, other references) for use by KTDC staff; and

(b) A line of credit to KTDC to finance industry-sponsored RD&E sub-projects carried out by industry and/or public research institutes.

B. Proposed Bank Loan

1. Loan Amount

4.03 The proposed Bank loan of US$50 million equivalent, including the capitalized front-end fee, would be made to KTDC and guaranteed by the Government. The loan proceeds would be used to finance about US$650,000 1/ equivalent of the foreign exchange cost of technical assistance, training and educational materials for KTDC; the balance of about US$49.35 million 2/ equivalent would finance the estimated foreign exchange costs of RD&E projects that KTDC expects to process during 1982-84. The cost of US$650,000 equivalent for the development of KTDC during 1981-84 is estimated to include 30 man-months of consulting and expert services (para. 3.16) at an average cost of US$12,000 per man-month including travel and subsistence allowance, for a total of US$360,000; 100 man-months of training (para. 3.17) at an average cost of US$2,500 per man-month, for a total of US$250,000; and US$ 40,000 worth of educational materials. In order to preserve the momentum of the project as KTDC had initiated its business operations and solicited sub-loan applications on the basis of an original project implementation timetable which had subsequently been delayed, it is recommended that the proposed loan include retroactive financing of US$1.5 million equivalent to cover KTDC approvals made after January 1, 1982. KTDC has agreed that the sub-projects to be retroactively financed will be subject to prior approval of the Bank before disbursement.

2. Features of the Loan

a. On-lending Rate

4.04 The proposed Bank loan would be lent to KTDC at the prevailing rate of 11.6% p.a. For conventional loans, KTDC would on-lend Bank funds to sub-borrowers for up to 10 years, including a grace period of up to 3 years, at an interest rate that would allow KTDC a spread of at least 2.25% (with an average spread of 2.5%) to cover its credit risk. Thus, sub-borrowers would be charged an interest rate of at least 13.85% p.a. KTDC's minimum spread of

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1/ KTDC has also obtained, through MOST, UNDP funds of US$350,000 mainly for training.

2/ It is currently envisaged that this will also include the 1.5% front end fee.

2.25% would be slightly higher than the spread of 2% that has been uniformly applied to previous Bank loans to financial intermediaries in Korea, such as KDB, KLB and SMIB. However, such a higher premium is justified and acceptable in light of the fact that, while these DFCs concentrate their lending activities in the market phase of the product life cycle (para. 2.34) with loans made mainly for hardware with substantial collateral requirements, the thrust of KTDC's operations belongs to the pre-market phase where a sizable portion of KTDC's conventional lending would be for software items with less or little collateral security and hence carry more risk. With regard to conditional loans, interest charges and spread would be included implicitly in the royalty payments negotiated with sub-borrowers on a case-by-case basis. KTDC will also be charged a commitment fee of 0.75% on the undisbursed portion of the loan. KTDC will pass on such commitment charges to its sub-borrowers.

b. Amortization Schedule

4.05 Bank loans to financial intermediaries normally have flexible amortization schedules which correspond to the expected aggregate amortization schedule of the sub-loans to be financed. KTDC, however, represents a special case. Aside from granting conventional loans, KTDC will gradually expand its conditional loan operations (para. 3.19). On such loans, not only will there be no fixed repayment schedule, but in fact on some loans KTDC may receive no repayment at all, as royalties would basically only be due from those sub-projects which are successful. Further, those sub-projects for which conditional loans are requested will necessarily be those for which the greatest risk is perceived by the sponsor. As a result, the expected returns from KTDC's conditional lending operations may not in fact materialize in the first 5 to 7 years. For this reason, and at the request of the Government and KTDC, the Bank loan would be made for 14 years, including 5 years of grace.

c. Free Limit on Bank Loan

4.06 Sub-loans in excess of the proposed free limit of US$300,000 equivalent will be reviewed by the Bank before approval. Sub-loans under this free limit will be reviewed ex-post. It is roughly estimated that, with the free limit of US$300,000, Bank review would be required for some 20-30% of the number of RD&E projects prior to KTDC's approval. Also, since KTDC is a new organization, it has been agreed that the first 10 sub-projects for conditional loans and the first 5 for conventional loans will be reviewed by the Bank before approval by KTDC, regardless of the amount of Bank financing. The level of the free limit will be reviewed from time to time to ensure that the Bank review an appropriate number of sub-projects prior to KTDC's approval.

d. Sub-loan Size

4.07 To ensure that the proceeds of the proposed loan are spread over a large number of sub-projects, sub-loans will normally have a ceiling of US$1.5 million equivalent per project. However, in exceptional cases, Bank financing could exceed this ceiling; in such cases, the Bank would reserve the option of reviewing KTDC's appraisal of the sub-projects in the field.

e. Foreign Exchange Risk

4.08 In the case of conventional lending, the foreign exchange risk on the Bank loan will be passed on to the sub-borrowers. With regard to conditional loans, the foreign exchange risk will be automatically passed on to the sub-borrowers, since the loans will be "repaid" in the form of royalty payments based on sales, rather than fixed repayments.

C. Procurement

4.09 The proceeds of the Bank loan would finance the foreign exchange cost of imported and locally procured equipment, materials, consulting services and training. Since KTDC's sub-loans would typically be relatively small (about US$0.3 million equivalent on average) and used to finance a sizable number of hardware and software items available from a limited number of suppliers, procurement would be made through international or local shopping in accordance with procedures acceptable to the Bank. Consulting service will be engaged in accordance with Bank guidelines for the use of consultants (August 1981).

D. Disbursement

4.10 The proposed Bank loan will be disbursed against (i) 100% of documented foreign expenditures for directly imported equipment, materials, services and training, and (ii) 60% of local expenditures 1/ for imported goods purchased off-the-shelf in Korea or locally manufactured equipment and materials. All contracts for local procurement below US$100,000 equivalent will be disbursed against statements of expenditures (SOE). Related documents will be retained by KTDC and made available for inspection by Bank supervision missions. Contracts above US$100,000 equivalent will require full documentation. The SOE procedure is justified taking into account the particular nature of RD&E projects, which normally involve small and numerous expenditures, and the capability of KTDC and its auditors to maintain SOE documentation and accounts and its close supervision, as a matter of necessity, of its RD&E sub-projects. The Bank loan is expected to be fully committed by end-1984 and fully disbursed by end-1986 (closing date December 31, 1986). The estimated quarterly disbursements are given in Annex 4. This disbursement schedule has been based on the estimated number of sub-projects to be processed by KTDC through 1984, as indicated in para. 3.23, and on the assumption that sub-project expenditures would be incurred evenly during a two-year period following KTDC approval.

E. Benefits and Risks

4.11 The project will foster the technological development of Korean industry and fill an important gap in the Korean capital market. In supporting industry's RD&E ventures, KTDC will put strong emphasis on sharing the risks with project sponsors and thereby will influence and reinforce industry's attitude towards further undertaking of RD&E activities. The financial support provided by KTDC will have a catalytic and multiplier effect on

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1/ Estimated to represent the foreign exchange content.

industry's RD&E investment necessary for the accelerated development of industrial technological capability. In addition, with its knowledge of the technological status of industry and technological trends through surveys and studies, KTDC will be capable of assisting industry in identifying areas in which it should focus its RD&E efforts. Also, through the process of appraising and particularly supervising its RD&E projects, KTDC will induce a measure of discipline, and hence increase the efficiency in industry's management and implementation of RD&E activities. Finally, KTDC will promote a closer link between industry and public research institutes, by encouraging and financing projects sponsored by industry and carried out by these research institutes.

4.12 The most important lesson from other institutions in the world that are of similar nature to KTDC is that, for this kind of risk-sharing financing operation to be successful, the institution must have autonomy and a strong, independent and entrepreneurial management, and the ability to attract and retain a competent and high-caliber professional staff. This condition has been met in the case of KTDC, as demonstrated by the strong support from the private sector and the high quality of the management team and professional staff that it has assembled, and the sound legal framework and operating policies and procedures that provide KTDC with the autonomy and flexibility of a private sector organization.

4.13 Another aspect, that is also of critical importance to KTDC, is the financial support that it requires during its early stage of operation. Unlike most of its counterparts in the world, which are government-owned and financed through government's annual budgets, the majority (60%) of KTDC's share capital is owned by the private sector. Due to the nature of the risk-sharing business, a new company, such as KTDC, is expected to experience losses of income during its initial years (5-10 years) of operations before earning profits when its risk-taking ventures begin to yield returns. During this period, KTDC should be able not only to withstand these losses, but also to mobilize additional funds from various sources including the capital market to continue and expand its operations. As such, the Government's firm commitment to provide KTDC with the necessary financial assistance, such as equity contribution and loans, as well as funds to cover a portion of KTDC's losses pertaining to its conditional loans (para. 3.04, 3.26 and 3.29) during this 5-10 year period would be crucial. The Government's continued financial support to KTDC during this institutional building period will be vital to KTDC as a viable and growing company.

V. AGREEMENTS

5.01 Agreements have been reached with the Government and KTDC that:

(a) the Government will exchange views with the Bank from time to time on its industrial RD&E policies (para. 2.33);

(b) the Government will provide KTDC, during 1982-84, with additional equity of Won 5 billion (para. 3.04);

(c) KTDC will raise additional equity of at least Won 2.5 billion from private sources during 1982-84 (para. 3.04);

(d) KTDC will require enough royalty payments from its conditional loans at least to provide for repayment of the principal amount of the loans plus interest and other charges at the same rate as applies to conventional loans (para. 3.08);

(e) KTDC will employ advisory services on a retainer or ad hoc basis up to December 31, 1984, on terms and conditions acceptable to the Bank (para. 3.16);

(f) KTDC will submit to the Bank by September 1, 1982, a detailed training and expert invitation program (para. 3.17);

(g) KTDC will review with the Bank by the end of each year beginning in 1982 the operational targets (conditional loans, conventional loans, equity investments) to be met by KTDC during the following year, and on the basis of such reviews, adopt such targets as shall be mutually acceptable to KTDC and the Bank (para. 3.19);

(h) KTDC will submit to the Bank its annual accounts, audited by external auditors acceptable to the Bank, and the auditors' report within 4 months after the close of each year (para. 3.22);

(i) the Government will provide KTDC, during 1982-84, with additional loan funds and Government guaranteed KTDC bonds totalling Won 14 billion on terms and conditions acceptable to the Bank (para. 3.26);

(j) the Government will provide KTDC with supplemental financing (to cover losses on conditional loan operations over a limited period of time) in a manner acceptable to the Bank (para. 3.29); and

(k) KTDC will obtain Bank's consent prior to contracting any long-term debt(s), if such debt(s) would cause KTDC's debt/equity ratio to exceed 4 to 1 (para. 3.34).

5.02 Based on the above agreements, the proposed project is suitable for a Bank loan of US$50 million equivalent. The proposed loan would be made to KTDC and guaranteed by the Government. Retroactive financing of US$1.5 million of KTDC's sub-projects is also recommended (para. 4.03).

Industrial Projects Department
February, 1982

KOREA

TECHNOLOGY DEVELOPMENT PROJECT

Projected Science and Technology Investments, Fifth Five Year Plan (1982-86)
(Won billion, constant 1981 price)

	Investment a/		Funding By Source		
	Value	% of GNP	Government	Private	Govt: Private
1982	670.6	1.4	328.6	342.0	49:51
1983	823.9	1.6	395.5	428.4	48:52
1984	996.4	1.8	468.3	528.1	47:53
1985	1,130.6	1.9	520.1	610.5	46:54
1986	1,279.4	2.0	575.7	703.7	45:55
Total, 1982-86	4,900.9		2,288.2	2,612.7	

Source: MOST

a/ The totals include R&D expenditures proper plus governmeot expenditures on activities in support of science and technology such qs international scholar exchange and science and technology promotion programs.

Industrial Projects Department
November 1981

KOREA

TECHNOLOGY DEVELOPMENT PROJECT

List of Public Research Institutes: Before and After the Merger (in December 1980)

	Before the Merger				After the Merger	
	Name	Acronym	Establishment Year	Location	Name	Acronym
1.	The Korea Institute of Science and Technology	KIST	1966	Seoul	The Korea Advanced Institute of Science and Technology	KAIST
2.	The Korea Advanced Institute of Science	KAIS	1971	Seoul	" "	"
3.	The Korea Atomic Energy Research Institute	KAERI	1973	Seoul	The Korea Energy Research Institute	KERI
4.	The Korea Atomic Fuel Development Corporation	KAFDC	1976	Dae-Duck	" "	"
5.	The Korea Institute of Machinery and Metals	KIMM	1976	Chang-Wong & Seoul	The Korea Machinery Research Institute	KMRI
6.	The Korea Research Institute of Ships	KRIS	1976	Dae-Duck	The Korea Machinery Research Institute	KMRI
7.	The Korea Institute of Electronics Technology	KIET	1976	Gumi	No Change	
8.	The Korea Telecommunicat-ions Research Institute	KTRI	1977	Seoul	The Korea Electrical and Telecommunications Research Institute	KETRI
9.	The Korean Electrical Research and Testing Institute	KERTI	1976	Seoul	" "	"
10.	The Korea Resource Development Research Institute	KRDRI	1976	Seoul	The Korea Energy Resource Research Institute	KERRI

11.	The Korea Integrated Energy Research Institute	KIERI	1977	Dae-Duck	The Korea Energy Resource Research Institute	KERRI
12.	The Korea Regional Development Research Institute	KRDI	1977	Dae-Duck	No Change	
13.	The Korea Research Institute of Chemical Technology	KRICT	1976	Dae-Duck	No Change	
14.	The Korea Standard Research Institute	KSRI	1976	Dae-Duck	No Change	
15.	The Korean Ocean Research and Development Institute	KORDI	1978	Seoul	No Change	
16.	The Korea Tobacco Research Center	KTRC	1978	Seoul	The Korea Ginseng and Tobacco Research Center	KGTR
17.	The Korea Ginseng Research Center	KGRC	1978	Seoul	" "	"
18.	The Korea Scientific and Technological Information Center	KORSTIC	1962	Seoul	No Change	
19.	The Korea Solar Energy Research Institute	KSERI	1978	Seoul	No Change	

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KOREA

TECHNOLOGY DEVELOPMENT PROJECT

Projected Investments In the National (R&D) Projects Programs, Fifth Five Year Plan (1982-86)

	Government Contribution Won billion 1981 price
Semiconductor and Computer	51.5
Fine Chemical	19.6
Automobile	39.4
Atomic Energy Safety	109.2
System Engineering	28.0
Total	247.7

Industrial Projects Department
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KOREA

TECHNOLOGY DEVELOPMENT PROJECT

Major R&D Programs, Fifth Five Year Plan (1982-86)

	Won billion 1981 price
Public Research Institutes	
Basic Overhead Support	375.2
R&D Program	507.9
Government Research Institutes	430.6
Universities	239.7
Other R&D Support Program	734.8
Total Government Program, 1982-86	2,288.2

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KOREA

TECHNOLOGY DEVELOPMENT PROJECT

KTDC - LIST OF SHAREHOLDERS

I. Industries	(Won '000)
A. Industry Groups	
1) Lucky Group	650,000
Gold Star Co. Ltd.	123,000
Gold Start Tele-electric Co., Ltd.	123,000
Gold Star Precision Co., Ltd.	73,000
Gold Star Electric Co., Ltd.	86,000
Gold Star Cable Co., Ltd.	86,000
Gold Star Instrument & Electric Co., Ltd.	36,000
Lucky Ltd.	123,000
2) Kukje Corporation Group	600,000
Kukje Corporation	175,000
Woun Poong Industrial Co., Ltd.	125,000
Union Steel Mfg. Co., Ltd.	100,000
Cho Kwang Trading Co., ltd.	75,000
Kukwe Construction Co., Ltd.	125,000
3) Sam Sung Group	650,000
Cheil Synthetic Textiles Co., Ltd.	200,000
Sam Sung Electronics Co., Ltd.	100,000
Cheil Sugar Co., Ltd.	125,000
Sam Sung Electron Devices Co., Ltd.	50,000
Sam Sung Electronic Parts Co., Ltd.	50,000
Korea Tele-Communication Co., Ltd.	125,000
4) Hyun Dai Group	650,000
Hyun Dai Motor Co.	30,000
Hyun Dai Engineering Co., Ltd.	35,000
Hyun Dai Electrical Engineering Co., Ltd.	20,000
Hyun Dai Engine Mfg., Co., Ltd.	20,000
Hyun Dai Heavy Industries Co., Ltd.	225,000
Hyun Dai Construction Co., Ltd.	200,000
Hyun Dai Rolling Stock Co., Ltd.	20,000
Hyun Dai Pipe Co., Ltd.	20,000
Hyun Dai Precision & Industry Co., Ltd.	20,000
Inchon Iron & Steel Co., Ltd.	30,000
Halla Construction Co.	30,000

5)	Hyo Sung Group	525,000
	Tong Yang Nylon Co., Ltd.	200,000
	Han Kook Tire Mfg. Co., Ltd.	50,000
	Toplon Co., Ltd.	25,000
	Tong Yang Polyester Co., Ltd.	100,000
	Hyo Sung Heavy Industries, Ltd.	100,000
	Hyo Sung Motors & Machinery Ind. Co.	25,000
	Hyo Sung Aluminum Co., Ltd.	25,000
6)	Dae Woo Group	500,000
	Daewoo Heavy Industries Ltd.	300,000
	Daewoo Shipbuilding & Heavy Machinery Ltd.	150,000
	Korea Steel Chemical Co., Ltd.	30,000
	Pungkuk Oil Co., Ltd.	20,000
7)	Dong Ah Construction Group	100,000
	Dong Ah Construction Ind. Co., Ltd.	50,000
	Korea Express Co.	50,000
8)	Doo San Group	100,000
	Oriental Brewery Co., Ltd.	30,000
	Dong San Construction & Engineering Co., Ltd.	20,000
	Han Yang Food Co., Ltd.	10,000
	Doo San Industrial Co., Ltd.	10,000
	Doo San Mfg. Co., Ltd.	10,000
	Doo San Glass Co., Ltd.	10,000
	Doo San Grain Co., Ltd.	10,000
9)	Han Jin Group	100,000
	Hanjin Transportation Co., Ltd.	19,000
	Hanil Development Co., Ltd.	29,000
	Korean Air Lines Co., Ltd.	35,000
	Korea Air Terminal Service Co., Ltd.	9,000
	Korea Aircraft Service Co., Ltd.	4,000
	Jedong Industries Ltd.	4,000
10)	Mi Won Group	50,000
	Miwon Co., Ltd.	25,000
	Seoul Miwon Co., Ltd.	25,000

11)	Shin Dong-A Group	50,000
	Taiheung Corporation	10,000
	Tae Sung Methanol Ind. Co., Ltd.	10,000
	Kong Young Sa Co., Lts.	10,000
	Sampoong Industrial Development Co., Ltd.	10,000
	Shin Dong-A Construction Co.	10,000
12)	Lotte Group	35,000
	Lotte Confectionery Co., Ltd.	15,000
	Lotte Aluminum Co. Ltd.	10,000
	Lotte Mfg. Co. Ltd.	5,000
	Lotte Fuji Film Co., Ltd.	5,000
13)	Korea Explosives Group	20,000
	Korea Explosives Co., Ltd.	8,000
	Korea Plastic Industric Corporation	8,000
	Korea Bearing Co., Ltd.	4,000

KOREA - TECHNOLOGY DEVELOPMENT PROJECT

B.	Individual Companies	1,487,700
1.	Ae Kyung Fast & Processing Co. Ltd.	5,000
2.	Ahn Gook Pharmaceutical Co., Ltd.	5,000
3.	Asia Cement Mfg. Co., Ltd.	4,000
4.	Anam Industrial Co., Ltd.	2,000
5.	Boo Kook Steel & Wire Co. Ltd.	10,000
6.	Chong Kun Dang Corp.	10,000
7.	Chon Bang Co., Ltd.	10,000
8.	Chun Heung Electric Indu., Co., Ind.	500
9.	Dae Il Chemical Co., Ltd.	10,000
10.	Dae Sung Industrial Co., Ltd.	20,000
11.	Dae Won Kwang Up Co., Ltd.	2,000
12.	Dae Young Electronics Ind. Co., Ltd.	20,000
13.	Dai Han Printing Ink & Paint Mfg. Co., Ltd.	10,000
14.	Dong-A Pharmaceutical Co., Ltd.	10,000
15.	Dong-A Motor Co.	20,000
16.	Dong Bang Oil & Flour Mills Co., Ltd.	20,000
17.	Doshin Industrial Co., Ltd.	10,000
18.	Gosandang Pharmaceutical Co.	500
19.	Hai Tai Confectionery Co., Ltd.	20,000
20.	Hanil Synthetic Fiber Ind. Co., Ltd.	100,000
21.	Han Jung Chemical Co., Ltd.	5,000
22.	Han Kuk Drop Forging Co., Ltd.	2,000

23.	Han Kuk Glass Industry Co., Ltd.	30,000
24.	Han Kuk Slate Ind. Co., Ltd.	20,000
25.	Han Kuk Yakult Milk Products Co., Ltd.	10,000
26.	Han Yang Metal Industrial Co., Ltd.	20,000
27.	Hans Toy Co., Ltd.	500
28.	Jin Young Press Machine Co., Ltd.	700
29.	Keong Nam Enterprise, Ltd.	20,000
30.	Kia Industrial Co., Ltd.	20,000
31.	Kolon (Nylon) Inc.	50,000
32.	Korea Petro Chemical Ind. Co., Ltd.	20,000
33.	Korea Integrated Special Steel Co., Ltd.	50,000
34.	Korea Pacific Chemical Corporation	20,000
35.	Korea Agriculture Chemicals Co., Ltd.	10,000
36.	Korea Fertilizer Co., Ltd.	10,000
37.	Korea Shipbuilding & Engineering Corp.	5,000
38.	Korea Tacoma Marine Industries, Ltd.	5,000
39.	Korea Electronics Co., Ltd.	5,000
40.	Korea Chemical Industrial Co., Ltd.	5,000
41.	Korea Zinc Chemical Ltd.	3,000
42.	Korea Green Cross Corporation	2,000
43.	Korea Gae Sung Industrial Co., Ltd.	500
44.	Korea Heavy Machinery Industries Ltd.	10,000
45.	Korean Oil Corporation	200,000
46.	Kukdong Oil Co., Ltd.	5,000
47.	Kyohaksa	3,000
48.	Kyong-Ki Chemical Mfg. Co., Ltd.	10,000
49.	Kyungbang, Ltd.	10,000
50.	Life Housing & Construction Co., Ltd.	50,000
51.	Mi Ju Co., Ltd.	5,000
52.	Nhong Shim Company Ltd.	2,000
53.	Nm Kwang Construction Co., Ltd.	20,000
54.	Oriental Precision Company Ltd.	50,000
55.	Oriental Chemical Ind. Co., Ltd.	10,000
56.	Pacific Chemical Industrial Co., Ltd.	50,000
57.	Poong San Mental Mfg., Co., Ltd.	30,000
58.	Poong Sung Electric Co., Ltd.	2,000
59.	Pumyang Co., Ltd.	2,000
60.	Sung Shin Cement Industrial Co., Ltd.	20,000
61.	Sam Yang Tire Inc.	50,000
62.	Ssangyong Cement Industrial Co., Ltd.	200,000
63.	Sam Ho Construction Co., Ltd.	10,000
64.	Song Woun Industrial Co., Ltd.	10,000
65.	Seoul Cast Iron Industry Co., Ltd.	5,000
66.	Sei Myong Electric Trade Co.	5,000
67.	Seil Industry Co.	5,000
68.	Shin Won Tong Sang Co., Ltd.	5,000
69.	Samsung Chemical Ind. Co., Ltd.	2,000
70.	Seoul Auto Body Industrial Co.	2,000
71.	Shin-Ah Electric Co., Ltd.	500

72.	Tae Kwang Industrial Co., Ltd.	20,000
73.	Tae Hwa Co., Ltd.	5,000
74.	Tong Yang Cement Mfg. Co., Ltd.	10,000
75.	Tong Yang Moolsan Co., Ltd.	5,000
76.	Tong Yang Commercial Co., Ltd.	2,000
77.	Tai Han Electric Wire Co., Ltd.	50,000
78.	Whacheon Machinery Works Co., Ltd.	2,000
79.	Yu Han Corporation	5,000
80.	Young Poong Corporation	4,000
81.	Young Poong Mining Co., Ltd.	3,000
82.	Young Il Chemical Co., Ltd.	500
83.	Yung Chang Akki Co., Ltd.	5,000
II.	Association	35,000
	Association of Industrial Research Institute	30,000
	Federation of Korea Machinery Industrial Corporation	5,000
III.	Banks	1,000,000
	The Bank of Seoul & Trust Co.	200,000
	Korea First Bank, Ltd.	200,000
	The Choheung Bank, Ltd.	200,000
	The Commercial Bank of Korea, Ltd.	200,000
	The Hanil Bank, Ltd.	200,000
IV.	Government	1,000,000
	TOTAL	7,552,700

Industrial Projects Department
November 1981

KOREA

TECHNOLOGY DEVELOPMENT PROJECT

KTDC's Board of Directors and Advisors as of April 28, 1981

Board of Directors

Name	Position	Background
Mr. Ju-Yung Chung	Chairman	Chairman, the Federation of Korean Industries, Chairman, Hyundai Group
Mr. Ip-Sam Kim	Representative Director and President	Former Executive Deputy Chairman, the Federation of Korean Industries Member, the Policy-Making Advisory Committee, Economic Planning Member, the Prime Minister's Administrative Improvement Commission
Mr. Chang-Dal Kim	Director and Executive Vice-President	Former Executive Vice President of the Asian Banking Corporation
Mr. Eung-Sun Lee	Director	Vice Minister, Ministry of Science and Technology
Mr. Ki-Jung Ryu	Director	President, Korea Federation of Small Business
Mr.Shin-Ku Huh	Director	Chairman, Association of Industrial Research Institute President, Gold Star Co., Ltd.
Me. Jin-Ku Kang	Director	President, Samsung Electronics Co., Ltd.
Mr. In-Sang Song	Director	Chairman, Tongyang Nylon Co., Ltd.
Mr. Woo-Choong Kim	Director	President, Dae Woo Industrial Co., Ltd.
Mr. Chung-Mo Yang	Director	Chairman, Kuje Group

Auditor

Mr. Chae-Kyum Kim		Representative Director & Executive Vice President Ssang Yong Cement Industries

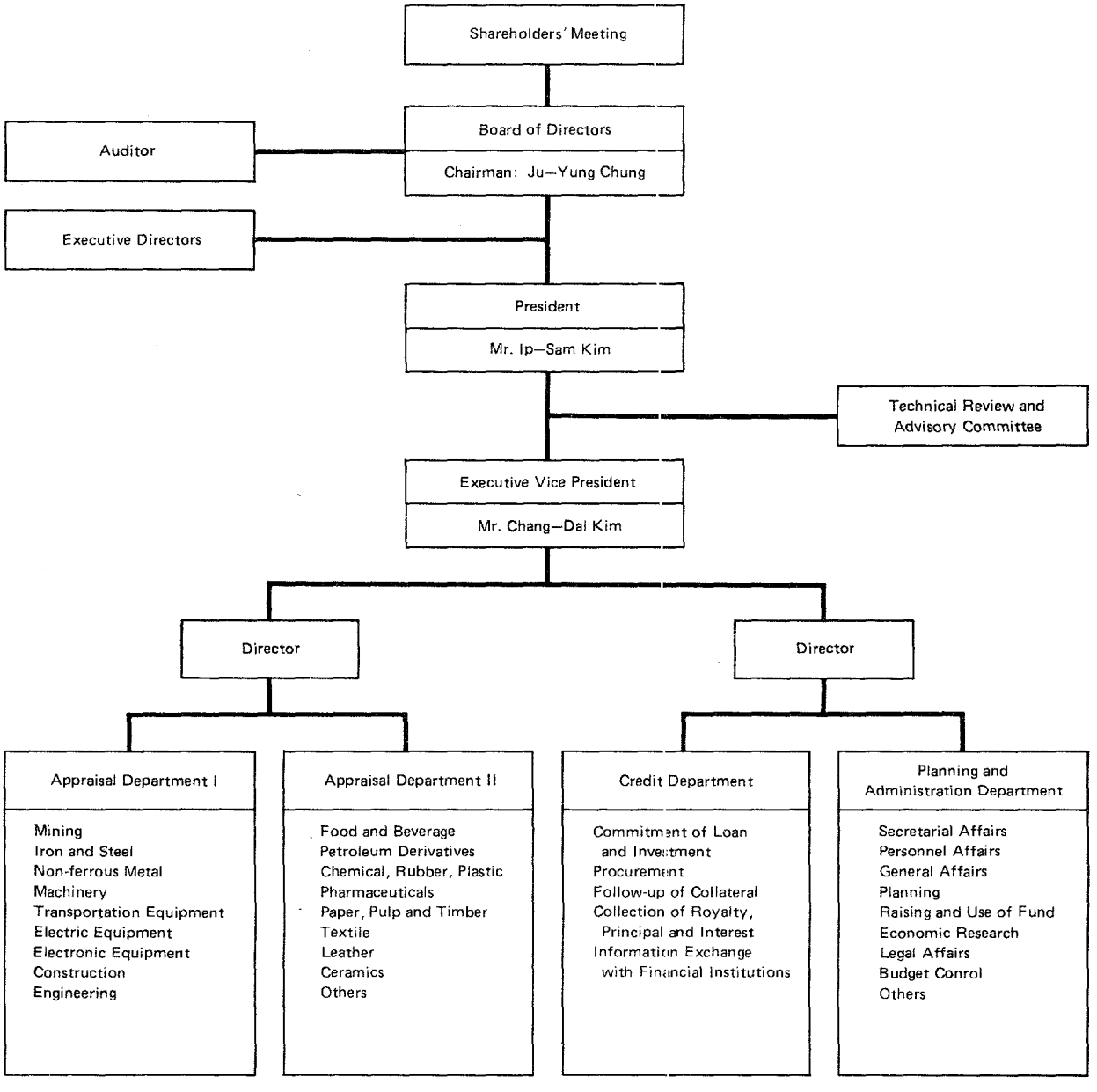
Advisors

Mr. Soo-Chang Chung	President, the Korea Chamber of Commerce and Industry
Mr. Chang-Soon Yoo	Chairman, Korean Traders Association
Mr. Yong-Joo Kim	Chairman, Korea Employers' Federation
Mr. Yeung-Ki Hah	Governor, the Korea Development Bank

Industrial Projects Department
November 1981

ANNEX 3-3

KOREA
TECHNOLOGY DEVELOPMENT PROJECT
KTDC – ORGANIZATION CHART



Industrial Projects Department
November 1981

World Bank – 23395

KOREA

TECHNOLOGY DEVELOPMENT PROJECT

KTDC's Statement of Investment and Operational Policies
(Approved at the Board of Directors' Meeting; May 25, 1981)

The Korea Technology Development Corporation (hereinafter referred to as KTDC), whose object is to promote the development of industrial technology of domestic enterprises thereby contributing to the improvement of the nation's industrial structure and by this means to strengthen international competitiveness, shall be guided by the policies set forth below:

I. The Scope of Investment Activities

1) KTDC shall, in principle, invest in the technology development of domestic enterprises. But in case of necessity, KTDC shall invest in the enterprises dealing with engineering services and venture capital in connection with the development of technology.

2) KTDC shall finance domestic enterprises which are properly organized and managed. KTDC shall not invest in enterprises which are foreign-owned and operated. But in case of necessity, KTDC may invest in joint venture with foreigners holding less than 50% of the voting stock.

3) In it's operations, KTDC shall give regard to the Government's general policy of technology development, and give high priority to the businesses listed below:
   (1) industries contributing to the renovation of technology;
   (2) export industries;
   (3) import-substitute industries;
   (4) industries which contribute to development and utilization of domestic resources and have great potential for reducing in the use of imported resources;
   (5) industries promoting international economic cooperation by developing technology.

4) KTDC shall assist domestic enterprises in the following ways:

   (1) conventional loan;
   (2) conditional loan;
   (3) equity investment;
   (4) survey, advice and mediation on the affairs which is related with technology development; and

(5) others

"Furthermore, KTDC Management shall endeavor to achieve the following operational targets set tentatively for the period indicated below:

Year	1982	1983	1984	1990
		(%)		
Conventional Loans	80	70	60	40
Conditional Loans	15	25	30	50
Equity Investment	5	5	10	10
Total	100	100	100	100

" 1/

5) KTDC shall perform as stated below toward technology development activities of domestic enterprises.

(1) Loans for in-house R&D costs and/or for cost of contracts for technology development with external research organizations;

(2) Investments and loans for initial efforts for the commercialization of the results of research and development and/or investigation and arrangement related thereto;

(3) Loans for technology import and/or loans for adoptation and improvement of imported technology;

(4) Loans for engineering costs for construction of industrial facilities;

(5) Technical advisory services to the industrial enterprises in respect to the business activities pursuant to the provisions from Item 1. through Item 4. and/or technical feasibility surveys for other R&D activities;

(6) Loans for procurement and installation of domestic R&D facilities;

(7) Loans for invitation and utilization of foreign specialists and technical advisers, and for training of R&D personnels domestically and abroad;

(8) Investigation and arrangement for the purpose of promoting the development of technology; and

(9) Other business activities incidental to those stated in the provisions from Item 1. through Item 8.

1/ Amended subsequent to loan negotiations.

6) KTDC shall provide priority ratio of financial support for domestic small and medium-sized enterprises every year by the resolution of Board of Directors for the purpose of technology development of such enterprises. "In particular KTDC shall exert itself to make available to small and medium sized enterprises not less than twenty percent (20%) of its financial resources in 1982 and not less than thirty percent (30%) of its financial resources in the period 1983 through 1985." 1/

II. Basis for Investment Decisions

KTDC shall make investment decisions on the basis of contribution of the project to development of domestic technology. At the same time, special attention shall be given to the ability of technology and management as well as profitability and public interest of the enterprise in financial and economic aspects.

III. Diversification of Assets

1) KTDC shall diversify its assets in order to meet capital needs of as many enterprises for development of technology as possible.

For this purpose, suitable consideration shall be given not to extend excessive investment and/or loan to the same industrial field or same business groups.

2) KTDC shall not extend loan and/or investment toward a single project more than 500,000 Won or foreign currency equivalent in principle. But in special occasion, the financial assistance which exceeds preceding amount may be provided by the resolution of the Board of Directors.

3) KTDC shall not commit to any single enterprise in the form of share capital more than 10% of KTDC's paid-in share capital and free reserves. The aggregate equity investment of KTDC at any case shall not exceed the total of its paid in-share capital and free reserves.

4) In undertaking large size projects or the projects which are regarded importantly by policy, KTDC shall seek cooperation with other financial institutions, both domestic and foreign.

1/ Amended subsequent to loan negotiations.

IV. Relationship With Enterprises Financed

1) KTDC shall take suitable measures to obtain adequate security and, at the same time, have the borrowers keep records and accounts in accordance with sound accounting practices. KTDC shall take the right to inspect the enterprises it finances as well as their operations and accounts.

2) KTDC shall not disclose business secrets and/or other information furnished by the applicants or clients in consideration of KTDC's distinctive characters of KTDC's operations.

V. Financial Guidelines

1) KTDC shall not incur any debt in excess of ten (10) times the aggregate of its paid-in share capital and free reserves.

2) KTDC shall maintain accounting records adequate to reflect its business operations in accordance with sound and generally accepted accounting practices and standards. KTDC shall employ qualified and independent public accountants to audit its books and certify the accounts annually.

VI. Profits and Their Distribution

1) KTDC shall seek to develop earnings sufficient to cover expenses and taxes, to provide reserves adequate to the size and risks of its assets and to protect its equity against erosion and to pay satisfactory dividends in the limits provided by related laws on KTDC. It will build and maintain reserves consistent with sound financial management. In addition, it will accumulate other reserves, as considered prudent by the Board of Directors.

VII. Fostering of Employees

KTDC shall build up a technically qualified staff capable of carrying the responsibilities which KTDC's objectives create, and able to provide the services to clients which those objectives call for. The employees shall not be reprimanded for the results of the tasks carried unless those are caused by intention or by serious negligence.

Industrial Projects Department
February, 1982

KOREA

TECHNOLOGY DEVELOPMENT PROJECT

KTDC - Rules on Lending and Equity Participation

Chapter I. General Provisions

Article 1 (Purpose)

The purpose of this Rule is to provide the terms and conditions of loans and equity investments and the appraisal and approval procedures thereon.

Article 2 (Principles of Application)

1) Lending and equity participation shall be conducted pursuant to the provisions of this Rule.

2) The provisions of the KTDC Act, the Presidential Decree, The Articles of Incorporation and the Basic Policy Statement shall prevail over the provisions of this Rule when they are in conflict.

3) The application of this Rule may be waived when there is a decision of the Executive Director's Committee to the contrary.

Article 3 (Eligible Projects)

Projects eligible for KTDC financing are as follows:

a. Research for the development of a new product (or process) or the improvement of an existing product (or process).

b. Marketing and production start-up for a new product.

c. Technology import and technical training.

d. Research for the improvement of the manufacturing process and engineering for the construction of plants, etc.

e. Purchase of equipment and materials for research activities.

f. Other technology development projects.

Article 4 (Limitation of Financing)

Loan or equity investments shall be denied to the following applicants:

a. A foreign-invested company. However, a foreign-invested company with foreign interests of less than 50% may be eligible if the project merits financing.

b. Those on the black list (Red or Yellow classified) of the banking group.

Article 5 (Forms of Financing)

Financing may be made in the following forms.

a. Conventional loan

b. Conditional loan

c. Equity investment

d. Mixture of the above

Article 6 (Financing Ratio)

The ratio of financing to the project cost shall be up to 70% for won-currency requirements and 100% for foreign exchange requirements.

Article 7 (Financing Criteria)

General criteria in lending and equity participation shall be as follows:

a. Feasibility of the project.

b. The possibility of commercialization of the outcome of the project.

c. Capability of the applicant in terms of financing, technology and management.

Chapter II. Appraisal and Approval Procedures

Article 8 (Appraisal Procedure)

Appraisal procedures shall be divided into the preliminary appraisal and the main appraisal.

Article 9 (Preliminary Appraisal)

The purpose of the preliminary appraisal shall be to determine the basic eligibility of the project for financing and the decision shall be made with the approval of the Director in charge.

Article 10 (Main Appraisal)

1) The Application for Financing shall be received for only those projects that have been found eligible through the preliminary appraisal. The Application shall enclose detailed project plans and other documents.

2) A Loan Appraisal Report shall be prepared for those projects that have been found viable in every respect.

Article 11 (Approval and Notice)

When the approval has been obtained for a project pursuant to the approval procedures stipulated in relevant by-laws, the applicant shall be given the Notice of Approval so that he can take the contracting procedures.

Chapter III. Conventional Loan (Won currency)

Article 12 (Interest Rate)

1) Interest rates shall be as provided in the Annex Table.

2) When the principals or interests due are not paid on the predetermined payment date default interests shall be charged.

Article 13 (Loan Period)

1) The loan period shall not exceed 10 years from the first disbursement date.

2) The loan period may include a grace period which does not exceed 3 years.

Article 14 (Repayment Method)

Principal shall be repaid in equal quarterly installments.

Article 15 (Interest Payment)

Interest shall be paid every 3 months in advance.

Article 16 (Commitment Fee)

Commitment fees shall be charged for the undisbursed portion of the loan commitment at the rate of (0.5% - 0.75%) per annum.

Article 17 (Security Arrangements)

All loans should be secured by collaterals in principle. However, the security requirement may be waived or reduced to the borrower who proposes a very good project and/or whose credit standing is excellent.

Article 18 (Kinds of Security)

1) Collaterals acceptable for security are as follows:

   a. Real estate

   b. Securities

   c. Moveable properties (limited to those that can be registered)

   d. Project equipment (to be obtained upon installment)

2) Bank payment guarantees may substitute for the above collaterals.

Article 19 (Secured Ratio)

The secured ratio should be 110% of the principal in the case of collaterals and 100% of the principal plus the interest for the next three months in the case of payment guarantees.

Chapter IV. Conditional Loan

Article 21 (Definition)

The conditional loan refers to the financing program under which royalties are charged during a period agreed upon on the sales

realized through commercialization of the research results when the project succeeds, while only a portion of the principal is repaid when the project fails.

Article 22 (Project Periods)

1) Project periods shall be divided into the execution period, the preparation period and the exploitation period which includes the royalty payment period.

2) The execution period means the period during which technology development is carried out through R&D, production of prototypes or construction of a pilot plant, sample production or market survey, etc. The preparation period means the period during which preparations for commercial production are made through the construction of plants and test operation of filing patent applications and registration, etc. The exploitation period means the period during which production and sales of the outcome of the project are realized or the patent rights are sold or leased.

Article 23 (Royalties)

1) Royalties shall be computed by multiplying the royalty rate by the royalty base.

2) Royalties shall be received regularly not less than two times a year, and the amount shall be adjusted after the end of each fiscal year in accordance with the result of the settlement of accounts.

3) Default interests shall be charged when the royalties are not paid in on due dates.

Article 24 (Royalty Base)

1) When the borrower itself commercializes the project result the sales revenue of the relevent product shall be used as the royalty base. The sales revenue here shall mean the sales amount reported under the Value Added Tax Law.

2) When the project result is sold or leased to someone else, the royalty base shall be the amount received therefrom, provided that the advisors fee, the brokerage fee, commissions and the technical service and training fees incurred in connection with the sale or lease are excluded from the royalty base.

Article 25 (Royalty Rate)

The royalty rate shall be determined through negotiations with the borrower at such a level as to make the present value of the expected royalty payments (royalty payments success probability) higher than the principal. For the calculation of the above present value the relevant interest rate for conventional loans shall be used as the discount rate.

Article 26 (Royalty Payment Period)

The royalty payment period shall not normally exceed 15 years and shall be determined taking into account the project type, the product life cycle, durable years of the production equipment, etc.

Article 27 (Minimum Repayment)

1) When the project has failed for the reasons that can be acknowledged by KTDC as justified, but not by the borrower's breach of contract or deliberate actions, the borrower's liability is relieved by simply paying the minimum repayment which amounts to not more than 30% of the loan principal.

2) The minimum repayment should normally be recovered immediately upon the confirmation of the project failure, provided that when the borrower's financial status is sound and stable, the minimum repayment may be recovered in installments within the maximum period of 3 years from the failure during which interest shall accrue at the interest rate applicable.

3) The minimum repayment liability of the borrower shall be reduced by the amount of royalty payments, if any, made to the date.

Article 28 (Commitment Fee)

The provision of the conventional loan shall be applicable.

Article 29 (Security Arrangements)

Securities representing at least 110% of the minimum repayment should be obtained in principle.

Article 30 (Kinds of Securities)

The provisions of the conventional loan shall be applicable.

Article 31 (Personal Joint Guarantees)

The representative or creditworthy executives of the borrower should in their personal capacity guarantee the borrower's obligations.

Article 32 (Project Failures Due to the Borrower)

When the project has failed due to the borrower's breach of contract or other reasons that KTDC cannot acknowledge as justified, KTDC shall on its own discretion request the repayment of the entire loan principal and default interests thereon regardless of the royalties received or shall request assignment of rights the borrower has obtained as a result of the project.

Chapter V: Equity Investment

Article 33 (Definition and Kinds of Investments)

KTDC's equity investments shall be made in the following two forms.

1) Direct investment
Direct underwriting of the capital shares of the company sponsoring the project.

2) Underwriting of debentures
Underwriting of convertible debentures issued by the project sponsor company.

Article 34 (Object of Investment)

Investments shall be made in such companies as intends to venture a technology-oriented project from which high financial returns are expected.

Article 35 (Special aspects to be studied for investments)

a. Financial structure of the company.

b. Profitability prospects.

c. Marketability of the shares or debentures.

d. The resulting change in the ownership status of the company when invested.

e. Any restrictive provisions in the articles of incorporation.

Industrial Projects Department
November 1981

KOREA - TECHNOLOGY DEVELOPMENT PROJECT

ANNEX 3-6

KTDC - Indicative Guidelines for Subproject Financing
(as % of subproject cost)

Type of Subproject / Attribute / Goal		Pay-back Period			Size of Firm				Relative Adv.				
					Large		Small						
		Less than 3 years	Less than 5 years	More than 5 years	First Effort	Experienced	First Effort	Experienced	Clear	Not Clear	Software	Hardware	
RD&E	Exp a/	80	50		60	80	50	80	80	50	80		*Up to 80% financing by KTDDC for highly profitable subprojects sponsored by the experienced firms.
	Imp b/	60	50		50	50	50	60	60	50	60		
	Other	70	50		50	50	50	70	70	50	70		*Up to 70% financing for the qualified small and medium scale firms.
Technology Transfer	Exp a/	70	50		50	50	50	70	70	50	70		*Up to 70% financing for the small and medium scale firms, but 50% financing for the large firms.
	Imp b/	50	50		50		50	50	50		50		*Conditional loans to large firms only for the first efforts subprojects.
	Other	60	50		50		50	60	60		60		
Marketing Start-up	Exp a/	70	50		50	50	70	70	70		70		*Conditional loans for the subprojects of international competitive advantage.
	Imp b/												
	Other												
Manufacturing Start-up	Exp a/	50					50		50		50		*No conditional loans to large firms.
	Imp b/												
	Other												
Manufacturing Process Improvement	Exp a/												
	Imp b/												
	Other												
Licensing Fees	Exp a/												
	Imp b/												
	Other												
Company's Infrastructure													

Qualifies for conditional loans

Qualifies only for conventional loans

No financing by KTDC

a/ Export creation
b/ Import substitution

Industrial Projects Department
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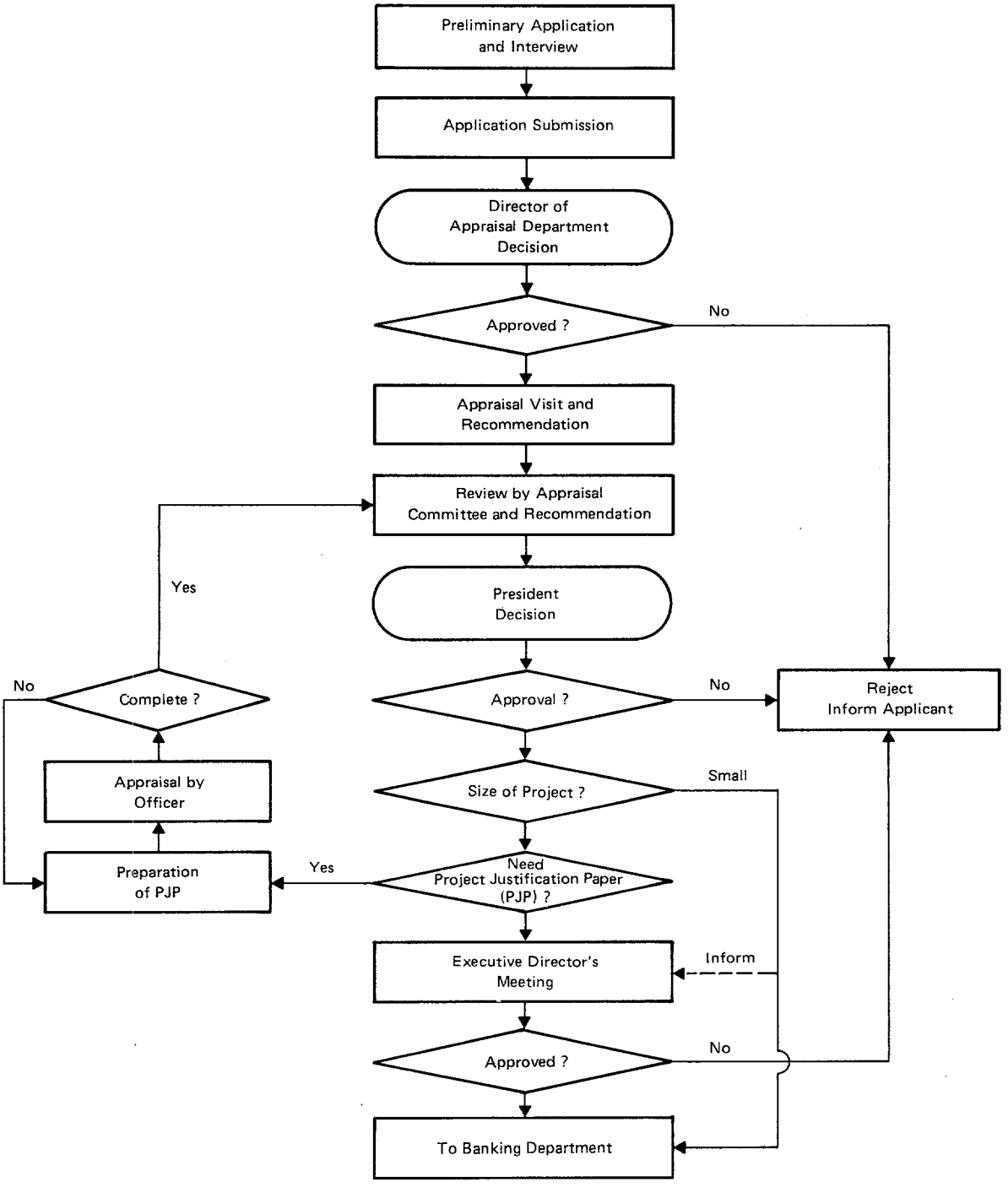
ANNEX 3-7

KOREA
TECHNOLOGY DEVELOPMENT PROJECT
KTDC – SUBPROJECT PROCESSING PROCEDURE FLOWCHART



Industrial Projects Department
November 1981

World Bank – 23394

KOREA

TECHNOLOGY DEVELOPMENT PROJECT

ASSUMPTIONS FOR FINANCIAL PROJECTIONS FOR KTDC, 1981-1990

1. The following assumptions are based on KTDC's estimates of its various business parameters and the results its investigative surveys of Korean industry's loan demands for RD&E subprojects in late 1980.

A. KTDC's Business Plan

2. In its surveys, the average sub-project costs were estimated to be about Won 200 million and Won 224 million in 1981 and 82, respectively; and, KTDC expects that average RD&E sub-projects size, thereafter would grow by about 5% per annum, as industry accumulates experience in RD&E ventures. Further, it was assumed that KTDC would finance about 70% of total sub-project cost on the average. Taking these into consideration, KTDC's average sub-project financing would increase over time, as indicated below.

KTDC Participation in RD&E Sub-projects
(In constant 1981 million Won)

	Average Sub-project Cost	Average KTDC Financing Amount per Sub-project
1981	200	140
1982	224	157
1983	235	165
1984	247	173
1985	259	182
1986	272	191
1987	285	200
1988	300	210
1989	315	221
1990	331	232

3. During 1981-90, KTDC would finance about 1,600-1,700 RD&E sub-projects originating from industry, or Won 330 billion in constant 1981 Won. Indicative annual financing program is given below:

Industrial RD&E Sub-project Financing by KTDC, 1981-90
(on commitment basis, in constant 1981 billion won)

	Annual		Cumulative		
	Number	Amount	Number	Amount	US$ Million Equivalent
1981 a/	25	3.5	25	3.5	4.9
1982	90	14.2	115	17.7	24.6
1983	125	20.6	240	38.3	53.2
1984	150	26.0	390	64.3	89.3
1985	165	30.0	555	94.3	131.0
1986	182	34.8	737	129.1	179.3
1987	199	39.8	936	168.9	234.6
1988	220	46.2	1,156	215.1	298.8
1989	241	53.2	1,397	268.3	372.6
1990	265	61.5	1,662	329.8	458.0

a/ Half year.

4. KTDC would offer the following types of financial support:

a) Conventional loans: Regular loans, to be repaid under predetermined conditions (interest rate, grace period, repayment period);

b) Conditional loans: Special loans that generally do not have to be repaid if the sub-project does not result in sales revenues, but that require royalty payments from sales if the sub-project is successful;

c) Equity investments: Equity participation in companies set up to commercialize RD&E results.

B. Composition of KTDC's Financing Operations

5. KTDC would gradually expand, and ultimately specialize, in conditional lending, as indicated below:

Financing Instruments as a Percentage of Total Approvals

	1981	1982	1983	1984	1985	1986-87	1988-89	1990
Conventional loans	95	80	70	60	55	50	45	40
Conditional loans	5	15	25	30	35	40	45	50
Equity investment	0	5	5	10	10	10	10	10
Total	100	100	100	100	100	100	100	100

6. Conventional loans would have the following terms and conditions on average:

(i) Loan rate of 15.5% p.a.;

(ii) Commitment fee of 1% p.a.;

(iii) Term of 7 years repayment including 3 year grace period;

(iv) Bad-debt rate of 2% of the approved amount;

(v) Disbursement pattern of straight line disbursement over two years, i.e., 50% of loan disbursed each year.

7. Conditional loans do not have a fixed repayment schedule. The return on conditional loans is in the form of royalty payments (a predetermined percent of sales revenue) from successful sub-projects. All conditional loans are amortized over a nine year period as losses occur, or as royalties are realized. The royalty revenue from conditional loans is estimated on the basis of:

(i) sub-project failure rate of 30%;

(ii) royalty rate of 5% of sales;

(iii) a number of forecasted sales profiles; and

(iv) a frequency distribution over the above mentioned sales profiles.

And, the following expected royalty revenue pattern in real terms is used for the purpose of financial projection:

Years b/	1	2	3	4	5	6	7
Expected value of Royalty Revenue from Conditional loans a/ (in multiples of conditional loan amount)	0	0	0.2	0.4	0.6	0.4	0.4

a/ Taking into account the failures.
b/ Years after sub-project implementation.

Based on these royalty payments, KTDC would earn an annual rate of return of about 10% p.a. in real terms on its conditional loans, on the average.

8. The disbursement pattern of conditional loans is same as conventional loans, i.e., two year straight-line disbursement.

9. It will take some time (say 5 to 7 years) before KTDC's conditional loan portfolio produces income. To strenghthen KTDC's financial position during the early phase of its operation, the Government of Korea is committed to provide additional funds to support KTDC's conditional loan losses on an annual basis over a limited period of time (about 7 years). For the purpose of financial projection, the Government is assumed to provide 50% of conditional loan failures, i.e., 15% of conditional loans approved, as they occur, i.e., four years after sub-project approval.

10. Equity Investment: 30% of companies set up jointly by KTDC and industry to commercialize RD&E results are assumed to fail. However, KTDC would sell its equity interest on successful companies after four years at about five times its original investment. Further, KTDC is not expected to receive any dividend from those companies. KTDC would then earn about 5% p.a. annual rate of return on its equity investments, on the average.

C. KTDC's Financing Requirements and Sources

11. To meet its financing requirements (para. 4), KTDC envisages the following long-term fund raising program:

	1981 a/	1982	1983	1984	1985	1986	1987	1988	1989	1990
(billion won)										
Equity:										
Private	6.5	1.5	1.0	0	6.0	5.0	4.0	1.0	0	0
Government	1.0	1.0	2.0	2	0	0	0	0	0	0
Total Equity	7.5	2.5	3.0	2	6.0	5.0	4.0	1.0	0	0
Debt:										
Government b/	1.0	7.0	5.0	2.0	0	0	0	0	0	0
Proposed IBRD Loan	0	36.0	0	0	0	0	0	0	0	0
Other Loan	0	0	0	0	15	20	20	18	18	11
Total Loan	1.0	43.0	5.0	2.0	15	20	20	18	18	11

a/ Actual figures.
b/ Including government guaranteed KTDC bonds.

12. IBRD loan would have the following terms and conditions:

(i) loan rate = 11.6% p.a.

(ii) commitment fee = 0.75% p.a. and front end fee of 1.5%;

(iii) 15 year repayment including 5-year grace period; and

(iv) disbursements made on the basis of KTDC's actual disbursements.

13. KTDC would not declare any dividend during the first ten years of operation.

14. Government loan would have the following terms and conditions:

(i) Loan rate = 13.5% p.a.;

(ii) 15 year repayment including 5-year grace period; and

(iii) Full disbursement in the first year.

15. Other loans would have the following average terms and conditions:

(i) Loan rate = 12% p.a.;

(ii) 15 year repayment including 5-year grace period; and

(iii) Full disbursement in the first year.

D. KTDC's Operating Costs and Overhead

16. Professional Staff Requirement:

It would take on the average about:

(i) 1.5 man-months of professional staff's time to appraise and approve a sub-project;

(ii) 0.7 man-months to supervise a sub-project during the sub-project implementation stage; and

(iii) 0.2 man-months to supervise a sub-project after the implementation.

17. KTDC would require one manager for ten professional staff.

18. KTDC would have two support staff for every three professional staff.

19. Annual base salary would be:

(i) Won 20 million (US$28,500 equivalent) for managers;

(ii) Won 12.0 million for professional staff; and

(iii) Won 5 million for support staff.

20. Administrative costs inluding stationaries, retirement contribution and other fringe benefits would be 1.3 times the salaries and wage costs.

21. Staff travel cost would be 0.05 times salary costs.

22. The actual KTDC's organization expenditure in 1981 was Won 269 million.

23. The actual KTDC's fixed asset acquisition in 1981 was 144 million, and KTDC would further acquire annually Won 40 million worth of fixed asset during the next 10 years.

24. Fixed assets and organizational expenditure would be depreciated in straight line over 10 years.

25. KTDC's earning on its liquidity would be 12% p.a.

26. KTDC would spend Won 70, 200, 200 and 200 million in 1981, 82, 83 and 84 respectively on its (foreign) expert invitation program.

Industrial Projects Department
February 1982

KOREA TECHNOLOGICAL DEVELOPMENT CORPORATION

FUND RAISING PROGRAM, 1981 – 1990

(CURRENCY AMOUNTS IN MILLION WON EQUIVALENT)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
FUND-RAISING										
EQUITY										
PRIVATE SECTOR	6500.0	1500.0	1000.0		6000.0	5000.0	4000.0	1000.0		
GOVERNMENT	1000.0	1000.0	2000.0	2000.0						
EQUITY AT YEAR-END BEFORE RESERVES	7500.0	10000.0	13000.0	15000.0	21000.0	26000.0	30000.0	31000.0	31000.0	31000.0
DEBT										
IBRD CREDIT LINE		36000.0								
GOVERNMENT LOAN	1000.0	7000.0	5000.0	2000.0						
OTHER LOANS					15000.0	20000.0	20000.0	18000.0	18000.0	11000.0
IBRD DISBURSEMENTS		3996.0	9756.0	12960.0	8280.0	1008.0				
GOVERNMENT DISBURSEMENTS	1000.0	7000.0	5000.0	2000.0						
OTHER LOAN DISBURSEMENTS					15000.0	20000.0	20000.0	18000.0	18000.0	11000.0
TOTAL DEBT AT YEAR-END	1000.0	11996.0	26752.0	41712.0	64992.0	85900.0	101140.0	113880.0	126420.0	130460.0
DEBT SERVICING										
IBRD CREDIT LINE										
PRINCIPAL REPAYMENTS							3960.0	3960.0	3960.0	3960.0
INTEREST CHARGES		463.5	1595.2	3098.6	4059.1	4176.0	3716.6	3257.3	2797.9	2338.6
COMMITMENT FEES		240.0	166.9	69.7	7.6					
SUBTOTAL		703.6	1762.1	3168.3	4066.6	4176.0	7676.6	7217.3	6757.9	6298.6
GOVERNMENT LOAN										
PRINCIPAL REPAYMENTS						100.0	800.0	1300.0	1500.0	1500.0
INTEREST CHARGES	135.0	1080.0	1755.0	2025.0	2025.0	2011.5	1903.5	1728.0	1525.5	1323.0
COMMITMENT FEES										
SUBTOTAL	135.0	1080.0	1755.0	2025.0	2025.0	2111.5	2703.5	3028.0	3025.5	2823.0
OTHER LOANS										
PRINCIPAL REPAYMENTS										1500.0
INTEREST PAYMENTS					1800.0	4200.0	6600.0	8760.0	10920.0	12060.0
SUBTOTAL					1800.0	4200.0	6600.0	8760.0	10920.0	13560.0
TOTAL DEBT SERVICING	135.0	1783.6	3517.1	5193.3	7891.6	10487.5	16980.1	19005.3	20703.4	22681.6

Industrial Projects Department
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KOREA TECHNOLOGICAL DEVELOPMENT CORPORATION

PROJECTED INCOME STATEMENTS, 1981 – 1990

(CURRENCY AMOUNTS IN MILLION WON)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
INCOME										
INCOME FROM LOANS	274.3	1442.8	3430.8	5595.8	7485.2	8963.1	10117.3	11021.5	12016.2	13079.2
ROYALTIES FROM CONDITIONAL LOANS					349.4	2385.6	6967.4	15921.2	25279.9	38837.6
LESS - AMORTIZATION EXPENSE					19.3	277.8	1151.4	2731.7	4825.8	7367.3
NET INCOME FROM CON. LOANS					330.1	2107.9	5816.0	13189.5	20454.1	31470.3
DIVIDENDS ON SHARES										
NET INCOME FROM DIVESTITURES						2959.1	4319.3	10868.9	12577.8	14559.7
TOTAL INCOME FROM PROJECTS	274.3	1442.8	3430.8	5595.8	7815.4	14030.0	20252.7	35079.8	45048.1	59109.3
EARNED GOVERNMENT SUPPORT					13.1	172.1	545.7	970.6	1372.2	1831.1
INTEREST ON LIQUID HOLDINGS	492.0	1014.1	1213.9	743.8	460.2	748.5	796.1	867.7	977.2	1491.5
TOTAL INCOME	766.3	2456.9	4644.7	6339.6	8288.7	14950.6	21594.5	36918.1	47397.5	62431.9
EXPENSES										
FINANCIAL EXPENSES	135.0	1783.6	3517.1	5193.3	7891.6	10387.5	12220.1	13745.3	15243.4	15721.6
SALARIES AND CONSULTANT EXPENSES	117.0	417.2	691.3	909.2	1145.3	1452.5	1764.5	2158.6	2594.8	3080.5
GENERAL AND ADMINISTRATIVE EXPENSES	152.1	542.4	898.7	1181.9	1488.9	1888.2	2293.8	2806.2	3373.3	4004.6
TRAVEL EXPENSES	5.8	20.9	34.6	45.5	57.3	72.6	88.2	107.9	129.7	154.0
PROMOTIONAL EXPENSES	70.0	200.0	200.0	200.0						
LOAN WRITE-OFFS		33.3	146.3	257.4	300.1	320.9	339.0	372.8	406.9	447.6
TOTAL CURRENT EXPENSES	480.0	2997.2	5488.0	7787.2	10883.2	14121.7	16705.6	19190.9	21748.1	23408.2
GROSS OPERATING INCOME	286.4	-540.3	-843.3	-1447.6	-2594.6	828.9	4888.8	17727.2	25649.4	39023.7
AMORTIZATION OF ORGAN. EXPENDITURE	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9
DEPRECIATION OF FIXED ASSETS	14.4	18.4	22.4	26.4	30.4	34.4	38.4	42.4	46.4	50.4
NET INCOME BEFORE TAX	245.1	-585.6	-892.6	-1500.9	-2651.9	767.6	4823.5	17657.9	25576.1	38946.4
CORPORATE INCOME TAX	73.5					230.3	1447.1	5297.4	7672.8	11815.0
NET INCOME	171.5	-585.6	-892.6	-1500.9	-2651.9	537.4	3376.5	12360.6	17903.2	27131.4

Industrial Projects Department
February 1982

KOREA TECHNOLOGICAL DEVELOPMENT CORPORATION

PROJECTED SOURCES AND APPLICATIONS OF FUNDS, 1981 - 1990

(CURRENCY AMOUNTS IN MILLION CURRENT WON)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
SOURCES										
CAPITAL INCREASES										
PRIVATE SUBSCRIPTIONS	6500.0	1500.0	1000.0		6000.0	5000.0	4000.0	1000.0		
GOVERNMENT SUBSCRIPTIONS	1000.0	1000.0	2000.0	2000.0						
FOREIGN SUBSCRIPTIONS										
LONG-TERM BORROWINGS										
GOVERNMENT LOAN	1000.0	7000.0	5000.0	2000.0						
IBRD LOAN		3996.0	9756.0	12960.0	8280.0	1008.0				
OTHER LOANS					15000.0	20000.0	20000.0	18000.0	18000.0	11000.0
NET INCOME	171.5	-585.6	-892.6	-1500.9	-2651.9	537.4	3376.5	12360.6	17903.2	27568.4
DIVESTITURES VALUED AT COST						706.5	1031.3	2595.0	3003.0	3476.2
LOAN PRINCIPAL REPAYMENTS				814.6	3584.1	7121.3	10935.9	14167.9	15656.7	16995.0
AMORTIZATION OF ORGAN. EXPENDITURE	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9
DEPRECIATION OF FIXED ASSETS	14.4	18.4	22.4	26.4	30.4	34.4	38.4	42.4	46.4	50.4
AMORTIZATION OF CONDITIONAL LOANS					19.3	277.8	1151.4	2731.7	4825.8	7367.3
WRITE-OFF OF BAD LOANS		33.3	146.3	257.4	300.1	320.9	339.0	372.8	406.9	447.6
TOTAL SOURCES	8712.8	12988.9	17059.0	16584.4	30588.9	35033.1	40899.3	51297.2	59869.0	66931.7
APPLICATIONS										
LOAN DISBURSEMENTS	1662.5	7314.5	12870.8	15003.8	16043.3	16948.8	18640.5	20345.0	22378.7	24280.7
EQUITY SUBSCRIPTIONS		706.5	1031.3	2595.0	3003.0	3476.2	3980.0	4620.0	5326.1	6148.5
CONDITIONAL LOAN DISBURSEMENTS	87.5	1147.3	3637.9	6470.6	9147.8	12207.7	14912.4	18355.0	22378.7	27355.0
TOTAL DISBURSEMENTS	1750.0	9168.3	17539.9	24069.4	28194.0	32632.6	37532.9	43320.0	50083.6	57784.2
ORGANIZATIONAL EXPENDITURE	269.0									
INCR. IN NET FIXED ASSETS	144.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
REPAYMENT OF PRINCIPAL ON BORROWINGS						100.0	4760.0	5260.0	5460.0	6960.0
PAYMENT OF BONUS										
PAYMENT OF DIVIDEND										
TOTAL APPLICATIONS	2163.0	9208.3	17579.9	24109.4	28234.0	32772.6	42332.9	48620.0	55583.6	64784.2
CHANGES IN CASH POSITION	6549.8	3780.7	-520.9	-7524.9	2354.9	2260.5	-1433.6	2677.2	4285.4	2147.5
YEAR-END CASH POSITION	6549.8	10330.5	9809.6	2284.7	4639.5	6900.0	5466.4	8143.7	12429.1	14576.6

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KOREA TECHNOLOGICAL DEVELOPMENT CORPORATION

PROJECTED BALANCE SHEETS, 1981 - 1990, AT DECEMBER 31

(IN MILLION CURRENT WON)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
ASSETS										
CURRENT ASSETS										
CASH AND LIQUID HOLDINGS	6549.8	10330.5	9809.6	2284.7	4639.5	6900.0	5466.4	8143.7	12429.1	14576.6
CURRENT PORTION OF LONG-TERM LOANS			814.6	3584.1	7121.3	10935.9	14167.9	15656.7	16995.0	16995.0
TOTAL CURRENT ASSETS	6549.8	10330.5	10624.2	5868.8	11760.8	17835.9	19634.3	23800.4	29424.1	31571.7
LONG TERM ASSETS										
LOANS OUTSTANDING	1662.5	8943.8	20853.6	32015.8	40637.7	46329.6	50463.3	54778.8	59755.6	66593.7
EQUITY INVESTMENTS		706.5	1737.8	4332.8	7335.8	10105.5	13054.2	15079.2	17402.3	20074.6
CONDITIONAL GRANTS OUTSTANDING	87.5	1234.8	4872.6	11343.3	20471.8	32401.6	46162.6	61785.9	79338.8	99326.5
TOTAL LONG-TERM PORTFOLIO	1750.0	10885.0	27464.0	47691.8	68445.2	88836.7	109680.1	131643.9	156496.7	185994.8
FIXED ASSETS AT COST	144.0	184.0	224.0	264.0	304.0	344.0	384.0	424.0	464.0	504.0
LESS CUMULATIVE DEPRECIATION	14.4	32.8	55.2	81.6	112.0	146.4	184.8	227.2	273.6	324.0
NET FIXED ASSETS	129.6	151.2	168.8	182.4	192.0	197.6	199.2	196.8	190.4	180.0
ORGANIZATIONAL EXPENDITURE	269.0	269.0	269.0	269.0	269.0	269.0	269.0	269.0	269.0	269.0
LESS - CUMULATIVE AMORTIZATION	26.9	53.8	80.7	107.6	134.5	161.4	188.3	215.2	242.1	269.0
NET ORGANIZATIONAL EXPENDITURE	242.1	215.2	188.3	161.4	134.5	107.6	80.7	53.8	26.9	
TOTAL ASSETS	8671.5	21581.9	38445.3	53904.4	80532.5	106977.9	129594.3	155694.9	186138.1	217746.5
LIABILITIES AND EQUITY										
LIABILITIES										
CURRENT LIABILITIES					100.0	4760.0	5260.0	5460.0	6960.0	6960.0
IBRD LONG-TERM DEBT		3996.0	13752.0	26712.0	34992.0	32040.0	28080.0	24120.0	20160.0	16200.0
GOVT. LONG-TERM DEBT	1000.0	8000.0	13000.0	15000.0	14900.0	14100.0	12800.0	11300.0	9800.0	8300.0
OTHER LONG-TERM DEBT					15000.0	35000.0	55000.0	73000.0	89500.0	99000.0
TOTAL LIABILITIES	1000.0	11996.0	26752.0	41712.0	64992.0	85900.0	101140.0	113880.0	126420.0	130460.0
EQUITY										
SHARES SUBSCRIBED	7500.0	10000.0	13000.0	15000.0	21000.0	26000.0	30000.0	31000.0	31000.0	31000.0
RETAINED EARNINGS	171.5	-414.1	-1306.7	-2807.6	-5459.5	-4922.1	-1545.7	10814.9	28718.1	56286.5
GOVERNMENT GRANT										
TOTAL EQUITY	7671.5	9585.9	11693.3	12192.4	15540.5	21077.9	28454.3	41814.9	59718.1	87286.5
TOTAL LIABILITIES AND EQUITY	8671.5	21581.9	38445.3	53904.4	80532.5	106977.9	129594.3	155694.9	186138.1	217746.5
FINANCIAL RATIOS										
DEBT-EQUITY RATIO	0.1	1.3	2.3	3.4	4.2	4.1	3.6	2.7	2.1	1.5
DEBT SERVICING RATIO	1.6	-	-	-	0.2	0.9	1.0	1.7	2.0	2.5

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ANNEX 4

KOREA

TECHNOLOGY DEVELOPMENT PROJECT

ESTIMATED DISBURSEMENT SCHEDULE

		Disbursement (US$ million)	
Fiscal Year	Quarter	Quarterly	Cumulative
1983	I	2.5	2.5
	II	3.0	5.5
	III	3.3	8.8
	IV	3.3	12.1
1984	I	3.4	15.5
	II	3.4	18.9
	III	4.5	23.4
	IV	4.5	27.9
1985	I	4.5	32.4
	II	4.5	36.9
	III	2.9	39.8
	IV	2.9	42.7
1986	I	2.8	45.5
	II	2.8	48.3
	III	0.5	48.8
	IV	0.4	49.2
1987	I	0.4	49.6
	II	0.4	50.0

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IBRD 12351R1
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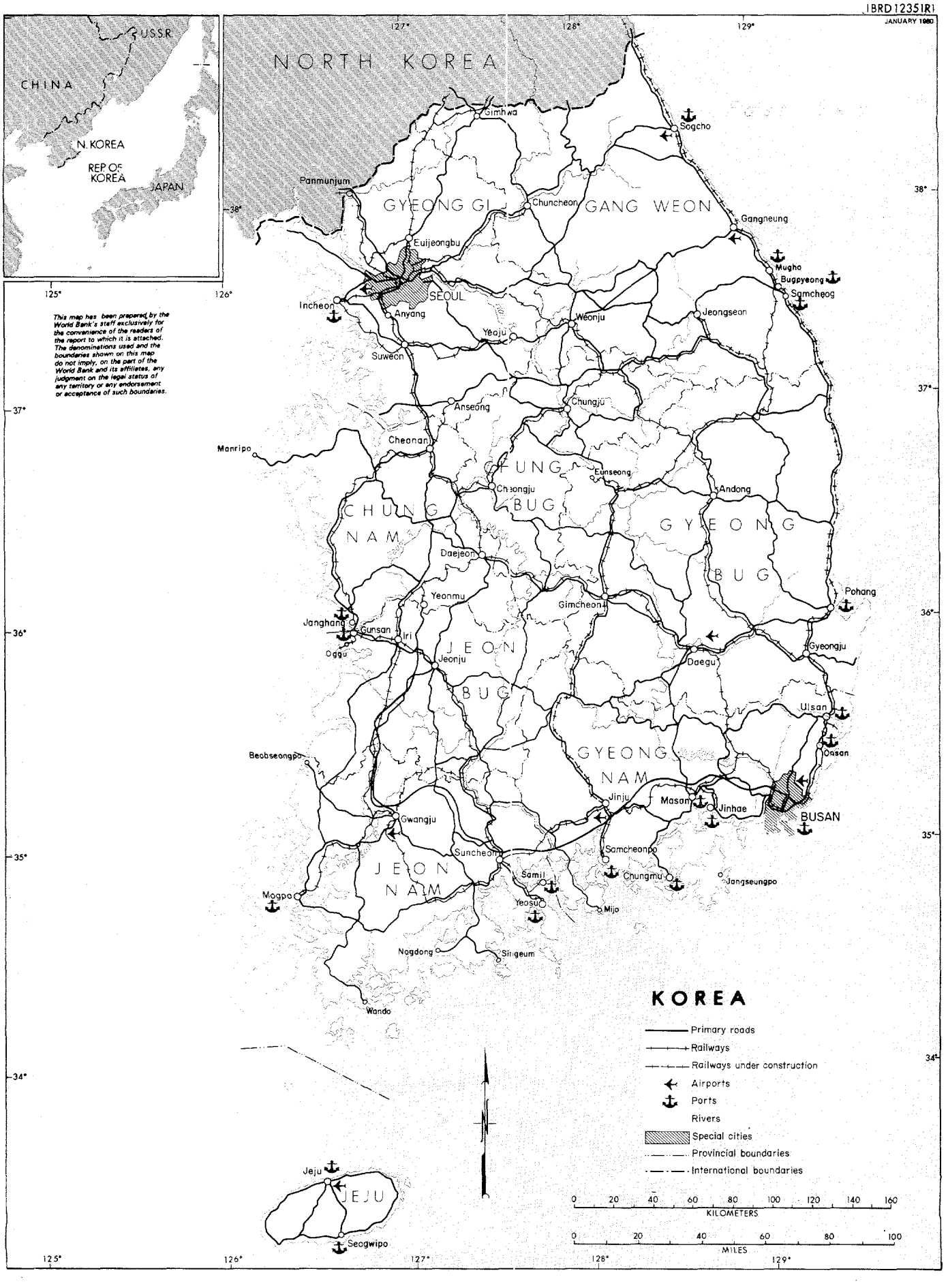

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KOREA

- Primary roads
- Railways
- Railways under construction
- Airports
- Ports
- Rivers
- Special cities
- Provincial boundaries
- International boundaries